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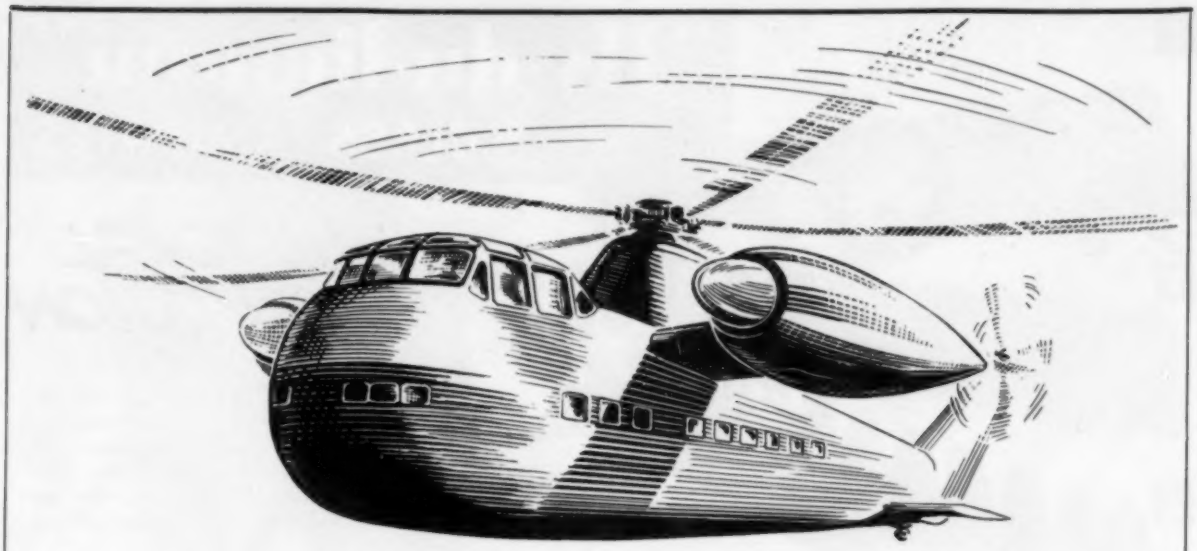

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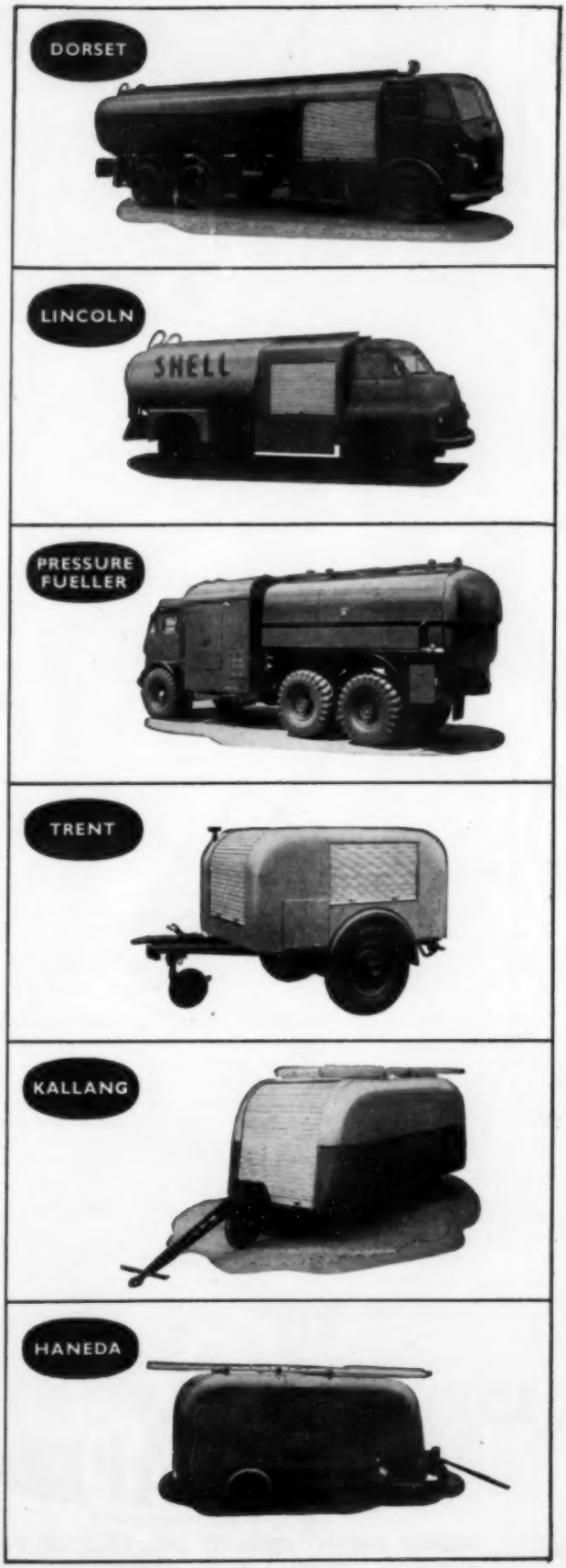

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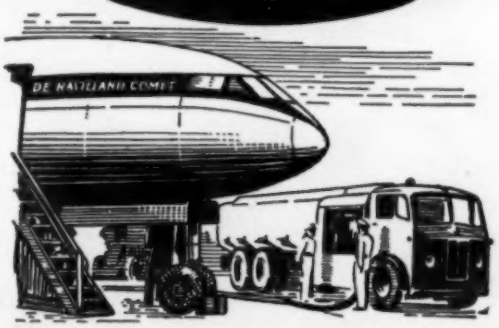

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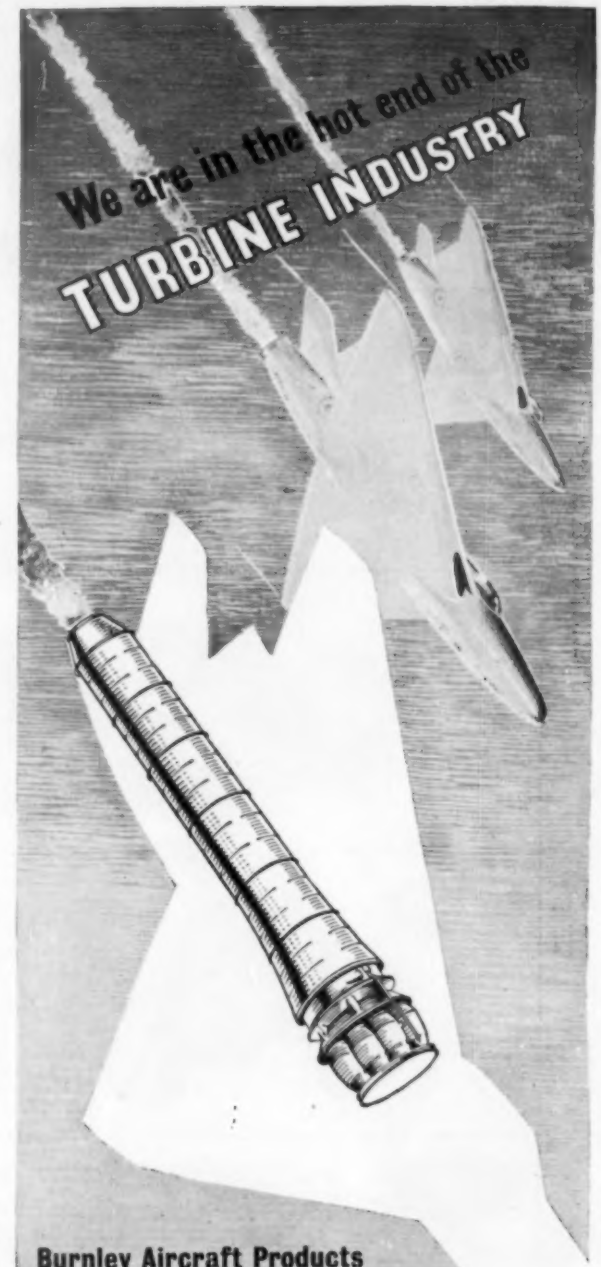

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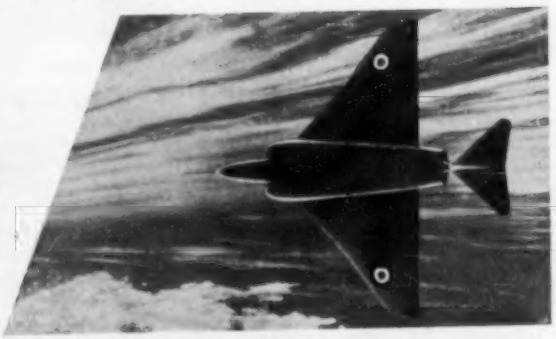

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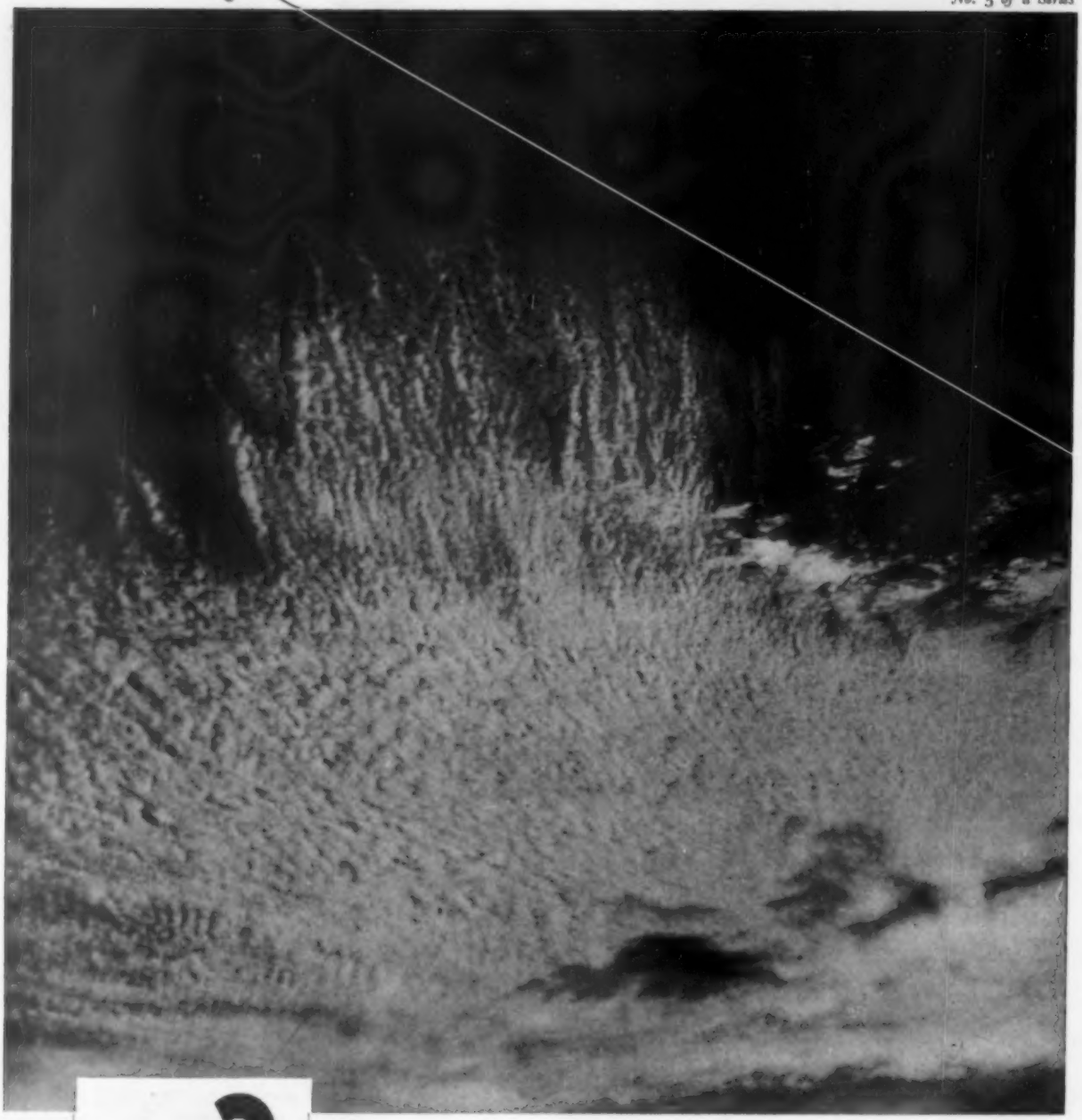

Weather map symbol for Cirro Cumulus

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The Art of Reconnaissance—

THE first occasion on which an aircraft of any kind was used for a military operation was the battle of Fleurus (1794), when the French republicans sent up a captive balloon for visual observation. Having contemplated this development for 84 years, the British Army authorities began experiments along similar lines, and for a quarter of a century thereafter they were flirting with lighter-than-air craft and man-lifting kites. The heavier-than-air machine came into the immediate ken of the British Army in 1910, when Captain Dickson and Mr. Robert Loraine reconnoitred Salisbury Plain in two Bristol Box Kite biplanes, thereby stirring the cavalry horses into restlessness and the authorities into the realization that air reconnaissance might be a battle-winning factor. By this time, of course, the French—the greatest of all artillerists—had provided some hundreds of machines for army use.

The first reconnaissance of the 1914 war was made by Captain Joubert de la Ferté, in a Blériot, and by 1918 the technique and equipment of British artillery observation and corps reconnaissance squadrons had advanced to the very forefront of development. Between the wars our army co-operation methods and material were certainly unsurpassed, and, in the late war, we developed the new technique of low-altitude tactical reconnaissance. Today our Tac.R. squadrons employ the Meteor F.R.9, and we have the Meteor P.R.10 and two marks of Canberra for high-altitude work over longer ranges. A version of the Swift has already been built as a Meteor F.R.9 replacement; so we have come a long way from the Balloon Section of the Royal Engineers, and have largely atoned for our early negligence.

—in Battle Royal

In Exercise Battle Royal, subject of articles in this and last week's issue, reconnaissance Meteors of the R.A.F. were working alongside Dutch and Belgian Thunderjets detailed for similar duties. The C-in-C. 2nd A.T.A.F. was, in fact, employing all his reconnaissance resources at maximum intensity—resources which included new ground equipment to improve the speed and quality of photographic processing and interpretation, as described in this issue. So, from the reconnoitring angle, the exercise was one of supreme importance—and the C-in-C. himself used that very phrase in describing air reconnaissance. "We must know," he went on, "where the enemy is before we can hit him. It is no use relying on A-weapons to win a battle without adequate and speedy reconnaissance to locate suitable targets." The enemy, he remarked, would also have an atomic capability, and it would be a most urgent requirement to locate his means of delivery in order to set about destroying them at source.

Battle Royal afforded an opportunity for 2nd A.T.A.F. to test and improve its procedures and equipment for visual and photographic reconnaissance by day and night, to process the pictures and reports, and translate them into intelligence upon which the operational staffs could act in the quickest possible time. (Though the C-in-C. himself referred to night photography as a 2nd A.T.A.F. commitment, it was, in fact, necessary to draft in a force of U.S.A.F. RB-26s to undertake the work. These machines are specially equipped for the job, and, though they proved their worth in Korea, still have no counterpart in the R.A.F.)

As things worked out, the air forces engaged were very successful at finding the 280 mm atomic guns and in putting them out of action, though the Americans, who loaned the weapons, considered that their speed, and the effectiveness of their camouflage, rendered them difficult to locate. On the debit side it was found that the reconnaissance squadrons were often grounded by weather, whereas the 280 mm. gun is an all-weather weapon. A senior officer of 2nd A.T.A.F. declared after the exercise that this problem would have to be looked at a great deal more closely. In his opinion, it would eventually be overcome; so we may hope that next year, when the use of ground-to-ground guided weapons will be simulated, the Tac.R. and P.R. pilots of 2nd A.T.A.F. will have been equipped with sufficient aids to enable them to deal more adequately with a menacing situation.

FROM ALL QUARTERS

The Duke Converts

TWICE last week the Duke of Edinburgh flew in a Meteor 7 with his instructor, F/L. C. R. Gordon. The two flights totalled rather over 1 hr 35 min, and during much of the time the Duke was handling the aircraft. The flights were made from R.A.F. Station West Raynham; the Duke and F/L. Gordon had flown over in a Chipmunk from Bircham Newton, which is adjacent to Sandringham, where His Royal Highness was staying.

The Duke of Edinburgh has, of course, put in a considerable number of hours on piston-engined aircraft since he first went solo in a Chipmunk at White Waltham on December 20th, 1952. During his recent holiday at Balmoral he made a succession of journeys at the controls of the new D.H. Heron of the Queen's Flight, mainly with the object of familiarizing himself with the position of various northern airfields. On these trips he flew from R.A.F. Station Edzell, with F/L. Gordon as co-pilot.

The news of the Duke's Meteor flights inevitably gave rise to the expression of newspaper opinion on the subject of his safety, and to a great deal of speculation, much of it obviously based on slender foundations. Among the more convincing conjectures was the *Daily Telegraph's* view that His Royal Highness would continue his jet flying, but with a safety pilot; the name of F/L. C. C. Blount, newly appointed as Equerry (Temporary) to the Queen, was coupled with this suggestion.

Offshore Javelins

FOUR contracts, totalling over £36.7m, have been placed with the Hawker Siddeley Group by U.S.A.F. Europe, as part of the Mutual Defence Assistance Programme. The contracts cover Gloster Javelin all-weather fighters, Hawker Hunter day intercepters, spare Sapphire turbojets and armament; it is probable that, as in previous off-shore orders, the Hunters will be Sapphire powered. All these aircraft are for the Royal Air Force.

The Hawker Siddeley Group have particular reason to be pleased with the Javelin contract, since this is "the first official word to come through from the U.S.A.F. on this aircraft." Javelin production is steadily gathering momentum, and is ahead of schedule at the moment.

Hunters for the "Fighting Cocks"

THE first R.A.F. squadron to receive Hawker Hunter fighters will be No. 43 (the "Fighting Cocks"), based at Leuchars, in Scotland. The unit is commanded by S/L. R. E. Lelong, D.F.C., a 37-year-old New Zealander who holds the U.S. Air Medal for valuable service as a Sabre pilot in Korea.

Those familiar with Service history of the inter-war period will remember that No. 43 was the first squadron to be equipped with the Hawker Fury biplane—the first true intercepter to be adopted for the R.A.F. That was in May 1931, when *Flight* declared, "We have waited a long time for a squadron of intercepter fighters to be located in our defence ring. The expected day has now come, and citizens may sleep sounder in their beds for the knowledge." Similar sentiments might well be voiced again, for the Hunter will quite outclass the Gloster Meteor, our present standard intercepter, as the Fury outclassed in performance the less specialized single-seat day-and-night fighters which it supplemented and supplanted.

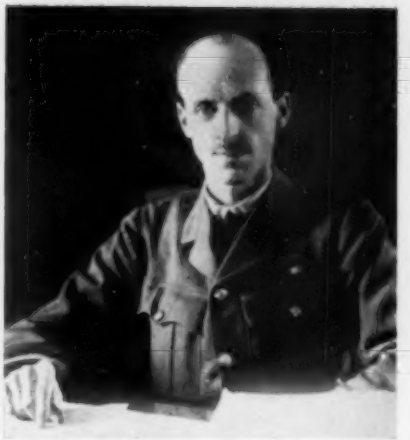
A history of No. 43 Squadron appeared in *Flight* of September 5th, 1952.

Sir Frederick Sykes

THE death of Major-General Sir Frederick Sykes, G.C.S.I., G.C.I.E., G.B.E., K.C.B., C.M.G.—in London on Thursday of last week, at the age of 77—severs another of the few remaining links with the earliest days of military aviation in this country.

It was he who, as a lieutenant-colonel, was given the responsibility of raising and then commanding the Military Wing of the Royal Flying Corps in 1912 (the R.F.C. was formed with both a Naval and a Military Wing). As early as 1904—when an officer of the 15th Hussars—he had obtained a balloon pilot's ticket and in 1911 he had been granted No. 95 pilot's certificate for aeroplanes; and he had narrowly escaped death in a crash while under instruction.

Lt-Col. Sykes was in command of the Military Wing during its concentration for annual training at Netheravon in 1914—a concentration which, though not recognized as such at the time, was in effect mobilization for war. He accompanied the four squadrons to France. In 1915, largely at the insistence of Mr. Winston Churchill, the Naval Wing became the Royal Naval Air Service, and in February 1915 Sykes was recalled from France and given command of the R.N.A.S. in the Eastern Mediterranean—i.e., for the Dardanelles operations. On his return to England a year later he received a War Office appointment.



Sir Frederick Sykes in Royal Air Force uniform in 1918, when he was appointed Chief of the Air Staff soon after the formation of the R.A.F.

"Flight" photograph

On January 1st, 1918, the Air Council was formed, charged with the task of creating the Royal Air Force as a self-sufficient arm independent of both the Army and Navy. General Trenchard—as he was then—was Chief of the Air Staff, but he did not see eye to eye with some of the members of the Air Council; and when, in March 1918, he tendered his resignation, Major-General Sykes was appointed to succeed him.

Sykes' next appointment was a civil one—as Controller-General of the Department of Civil Aviation on its formation in February 1919. He held this post for three years, during the formative period when the first experiments were being made with air services between London and Paris. During one of these flights he had his second narrow escape, getting away with minor injuries from a take-off crash in which the pilot was killed.

One who attended a luncheon at this period recalls a prophecy made by Sir Frederick Sykes (as he now was), who was among the speakers. Within 30 years, he said, aircraft would fly from England to Australia in four days with 20, perhaps even 30 passengers. The audience received this with polite laughter (Ross and Keith Smith had not then flown to Australia in 28 days).

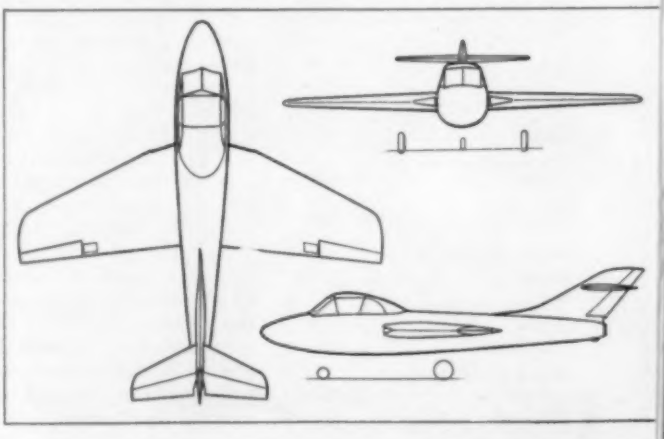
At the end of his three-year term of office Sir Frederick left the aeronautical scene, entering Parliament and later, from 1928 to 1933, acting as Governor of Bombay. Subsequently he was member of a number of Government committees, making one brief return to aviation affairs when, in 1938, he was appointed a member of the Air Transport Licensing Board.

He leaves a widow and one son.

New Basic Trainer

EXHIBITED in model form at the recent S.B.A.C. show, the Boulton Paul P.124 "has been projected to meet future requirements for a jet basic trainer for world-wide operation." Bearing a certain resemblance to the Jet Provost, the new Boulton Paul would be somewhat faster, owing to its smaller size and lower drag. As in the Balliol, pneumatic operation has been

THE BOULTON PAUL P.124 (see "New Basic Trainer," above) is to be powered with a Viper 101. The span is 32ft, the all-up weight 5,380 lb, maximum and stalling speeds 380 and 71 m.p.h., and take-off and landing runs over 50ft are just over 600 yd.



selected for the undercarriage (tricycle type with steerable nose-wheel, capable of accepting 14 ft/sec descent), flaps, air brakes and wheel brakes. Side-by-side seating is provided, and provision is made for equipment for gunnery, bombing, rocketry and navigational training. The P.124 design is fully aerobatic, and both instructor and pupil should enjoy an exceptional view.

A. Cdre. Banks Joins Bristols

ONE of our greatest authorities on aero engine design, particularly in relation to fuels, has been elected to the Board of the Bristol Aeroplane Co., Ltd. He is A. Cdre. Banks, C.B., O.B.E., F.R.Ae.S., M.I.Mech.E., F.Inst. Pet., Commander of the Legion d'Honneur, Commander of the Legion of Merit (U.S.A.).

A. Cdre. Banks.

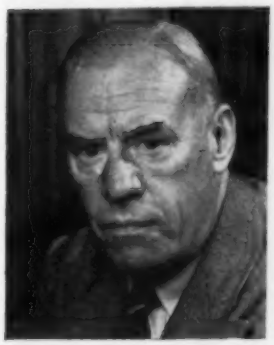
After serving in the R.N.V.R. in the First World War, he was engaged on experimental work with marine diesels and later with aero engines. Specializing in fuel research, he was responsible for the preparation of the fuels for the 1929 and 1931 Schneider Trophy contests, and for those used in many land, sea and air record-breaking attempts. He was for many years technical manager and chief engineer to the Associated Ethyl Co., Ltd.

In 1939 he joined the R.A.F.V.R. and was posted to Boscombe Down. When the Ministry of Aircraft Production was formed in 1940 Lord Beaverbrook invited him to organize a Directorate to speed-up the supply of engine accessories, and subsequently he was made Director General of Engine Production. In 1944 he was made Director of Engine Development, in which post he was responsible for the development of both piston engines and gas turbines. He held this position until he was demobilized in 1946, in which year he returned to Associated Ethyl. In 1952 he was loaned to the Ministry of Supply in order to undertake, as Principal Director of Engine Research and Development, the forward planning of the new engine-production programme.

A. Cdre. Banks began his duties at Filton last Friday; as an adviser on technical policy his experience will be available to all the Bristol Company's branches at home and overseas.

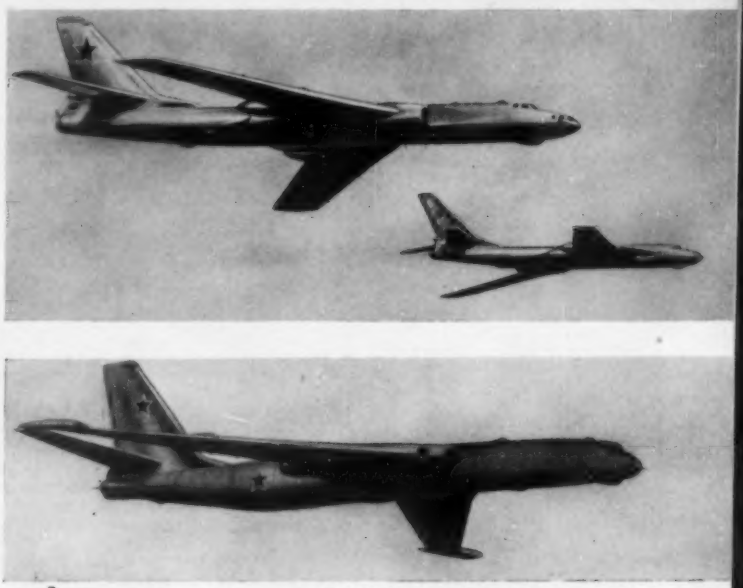
New Aerodynamics Head at Cranfield

THE appointment of Dr. J. A. J. Bennett, Ph.D., D.Sc., D.I.C., F.R.Ae.S., as Professor of Aerodynamics at the College of Aeronautics, Cranfield, has been announced. He succeeds Professor A. D. Young, M.A., F.R.Ae.S., who has been appointed to the chair of Aeronautical Engineering at Queen Mary College, London. The field of helicopter development is Dr. Bennett's special interest: for the last two years he has been engaged on helicopter research with the American Hiller company, and was previously for seven years head of Fairey Aviation's helicopter branch in this country.



CAPT. K. J. G. BARTLETT, C.B.E., who, as reported last week, has been elected president of the Fédération Aéronautique Internationale. He joined the Bristol Aeroplane Co., Ltd., in 1928 as a Continental representative and was made a director in 1943.

MR. H. W. GOODINGE has been appointed assistant director of the Society of British Aircraft Constructors, responsible to the director, Mr. E. C. Bowyer, C.B.E., on technical and exhibition matters. He has been concerned in the staging of every S.B.A.C. Display since 1932.



BADGER AND BISON: The Russian "Type 39" Badger (top) has large lateral intakes and a main undercarriage geometry similar to that of the Valiant 2. The Bison, lower view, is a huge but conventional aircraft (see "Russians Code-named," below).

Russians Code-named

MANY readers will remember the system of code-names which operated in the Pacific in 1944-45 under which Japanese bombers were given girls' names, fighters boys' names, and so on. A recent issue of *Naval Aviation News*, a U.S. Navy publication, has—according to *Aviation Week*—disclosed that the U.S. armed forces are assigning similar code names to Russian aircraft; in this case, however, bombers have names beginning with "B," fighters with "F" and transports with "C," thus following U.S.A.F. designations.

The two most advanced machines are to be known as Bison and Badger. Both flew in this year's May Day parade, and are illustrated here in drawings prepared from actual photographs. Bison (or Type 37) is a very large four-engined bomber, rather like a much-enlarged Valiant; Badger (or Type 39) is a heavily swept twin-engined bomber of roughly the same size as our own V-bombers. Both machines must be powered by turbojets of very considerable thrust (one would suppose almost twice the thrust of the latest turbojets in British or American use).

The third drawing shows Bosun (bearing Bison in mind, this seems a phonetic hazard), a twin-engined naval attack and anti-ship bomber with a radius of action greater than 600 miles. The familiar twin-jet Il-28 is styled Butcher, the Tu-4 copy of the B-29 becomes known as the Bull, and other appellations include Bob (Il-4), Fang (La-11), Buck (Pe-2), Frank (Yak-9), Coach (Il-12), Bat (Tu-2), and Beast (Il-10).

Handley Page in Australia?

THE deputy chairman of Handley Page, Ltd., A. Cdre. A. V. Harvey, mentioned in Sydney recently that the possibility of his company opening a factory in Australia was to be investigated during his two-week visit. With him was Mr. R. S. Stafford, the company's technical director. A. Cdre. Harvey was to have talks with leaders of the Australian Government—including the Prime Minister, Mr. Menzies—concerning air defence, with, it is supposed, particular reference to the Victor.

G/C. A. F. Bandidt, Handley Page's export sales manager, is reported to have said in Melbourne on September 24th that his company might enter the guided-missile production field in Australia. The H.P. party will visit the Woomera rocket range and the Long Range Weapons Establishment at Salisbury, near Adelaide.

A Loss to Brough

WE regret to learn of the death of Mr. E. Mitchell, works manager of the engine division of Blackburn and General Aircraft, Ltd., on October 1st. Mr. Mitchell joined the company from de Havillands in 1938 and was appointed chief engineer of the Cirrus engine section. He was transferred to Sherburn-in-Elmet when Blackburns began emergency production there, but returned to Brough after the war. Since then he had been largely responsible for the production of the Bombardier engine and, with the establishment of a gas turbine production line at Brough, was appointed works manager of the engine division.

Mr. Mitchell's death followed an illness of some months' duration. He leaves a wife and two daughters.

TRAINING CARRIER

After Fourteen Years' First-Line and Training Service "Illustrious" is Going to Reserve

Capt. K. A. Short, D.S.O., R.N.

IT always seems something of a tragedy when a thoroughbred, nearing the end of its career, has to assume the rôle of work-horse; but the job it does can sometimes be as important as those it performed in more famous days. So it is with H.M.S. *Illustrious*: at one time the very latest thing in aircraft carriers and now a trials and training ship, soon to go into reserve and possibly to be scrapped.

Her present duties consist mainly in providing deck-landing practice for Fleet Air Arm schools and squadrons, but No. 815 Squadron, R.N. (Lt.-Cdr. C. W. Rusbridger) is on board, flying Avengers, and two Fairey Fireflies constitute the ship's communication flight. Taking the place of the attendant safety ship are three Westland S-51 Dragonflies, one of which flies on the starboard quarter during flying operations. For night flying, however, a safety ship—usually a frigate—is still employed. She keeps station on the starboard bow and carries a red light at the masthead to give pilots taking-off a height mark to replace the unseen horizon.

Naval pilots trained in Britain make their first 20 introductory deck landings on the training carrier and before "hitting the deck" for the first time will have done 250 to 300 hours' flying with a minimum of 50 hours in the type being landed. Those pilots trained in the United States are in a different category for, in addition to reaching U.S.N. Wings standard, they have done six deck landings on Harvards and a further 12 on Avengers.

The deck handlers come to *Illustrious* at the conclusion of a three-months' course at the Gosport School of Aircraft Handling. As would be expected, postings to the newer carriers cause a quick turnover of experienced deck crews.

With an intensive training programme continually in progress—950 day and night deck landings and 210 helicopter landings were made in a recent period of 12 flying days—it would be expected that the incident rate would be rather high. Yet this is not so; over a period of twelve months there has been only one incident per 230 landings and one "write-off" per 4,600 landings. These figures are all the more remarkable when it is remembered that roughly one third of the training landings are made by pilots of jet aircraft.

Cdr. D. W. Kirke, O.B.E., R.N. (Commander Air).

The trials aspect of the ship's work is now virtually non-existent so far as aircraft are concerned. *Illustrious* has coped with everything up to and including the Sea Venom and Sea Hawk, but she has not the equipment to handle swept-wing types. Simply stated, this means that the ship's arrester and accelerator gear can deal only with speeds up to 66 knots. Add to this the 40 kt airspeed over the deck and it is clear that only aircraft with touch-down and take-off speeds of 100 kt or less can

In the two photographs on the left, Sea Hawks from R.N. Air Station Lossiemouth are arriving on and departing from the flight deck of H.M.S. "Illustrious" in the Channel last week. (Above) The aft round-down provides a grandstand for handling crews to watch No. 815 Squadron Avengers attack a towed target. The shooting was very good.

"Flight" photographs

Instructors flying the Sea Balliols on the right are giving air experience to students from the Junior Officers' Air Course at Lee-on-Solent. The huddle below shows hands in deck-handling rig clearing away the soft soap used near the accelerator to facilitate turning aircraft accurately in position.

"Flight" photographs

be handled. In the newer carriers the gear is designed to deal with a differential of 80 kt, and the steam catapult as much as 110 kt.

These limitations are made evident when Sea Hawks use the deck. As a safety precaution a man is then stationed on the "goofers' platform" to note exactly how far the arrester wires are drawn out. This distance is easily calculated from the known position of each wire and the deck length marked every 20ft along the amidships line. The maximum pull-out allowed is 150ft—at 160ft the wires come up against end-stops—but with 40 kts of wind over the deck the Sea Hawks average 135ft. No crash barriers are erected while jets are flying and every inch of deck is used for take-off; even so, the wheels are still running on the deck as the aircraft go over the bow.

Commanding *Illustrious* is Captain K. A. Short, D.S.O., R.N., who is himself a Naval observer with some 1,500 hours' flying. His first carrier appointment was to H.M.S. *Courageous* in 1933 when he flew in Blackburn Baffins and Ripons and Fairey IIIFs and Seals. This was followed by appointments to *Royal Sovereign* and *Enterprise*, both of which carried Hawker Osprey sea-planes on board. These were catapulted from the deck and recovered by crane after landing in a "slick" made by turning the ship.

By 1938 Capt. Short was back in *Courageous* as Senior Observer of No. 820 Squadron (Fairey Swordfish) and the next year transferred with the squadron to *Ark Royal*. When war came he was Air Staff Officer in H.M.S. *Hermes* but within a year was at the Admiralty, on duties concerned with naval/air aspects of radar. His next sea command came at the end of 1943 as captain of the escort carrier H.M.S. *Campania* and it was while in this ship, escorting convoys to Russia, that he was awarded the D.S.O. Since the war ended his chief air appointments have included a period as Chief Staff Officer to Flag Officer Flying Training, and another as Director of Air Organization and Training.

It is Capt. Short's intention, if at all possible, to hold the next Taranto reunion in the ship. This seems even more appropriate when it is remembered that No. 815 Squadron, which was formed from survivors of Nos. 811 and 822 when *Courageous* was sunk, is now on board and operated from the ship against Taranto.

With only three months to elapse before this very aptly named and much loved ship goes into reserve, it would be inappropriate not to give a short history.

Illustrious was launched at Barrow-in-Furness in April 1939 and completed in 1940. She is the fourth ship of the Royal Navy to bear the name: the first was a Third Rater, built in 1789, mounting 74 guns.

Urgently needed by Admiral Cunningham in the Mediterranean—very much so because of her armoured flight deck—*Illustrious* was dispatched to join his flag in August 1940, acting as escort to a valuable convoy on the journey. Her Commanding Officer was then Capt. (now Admiral Sir) Denis W. Boyd, D.S.C., R.N., who later became Fifth Sea Lord.

Joining the Mediterranean Fleet on August 31st, *Illustrious* was immediately successful, for on that same day her Fairey Fulmars intercepted a flight of Italian reconnaissance bombers and shot down two of them. This was but the first shot of a campaign which, in conjunction with the *Ark Royal*, was to lead to complete air ascendency over the Italian Air Force.

Later in 1940, on November 11th, came the night attack on the Italian fleet in Taranto harbour. The outcome of this one operation alone justified the existence of *Illustrious* because the

(*Continued on page* 568)

With rules all of its own this helicopter, after a sideways approach, lands-on facing aft, with the ship in a sharp turn. As the wheels touch the deck, the deck handlers put chocks fore and aft, and for good measure sit on the wheels.

SILENCING THE SWIFT

Supermarine Install Their First Ground-Running Noise Muffler

NOISE from aircraft has been much in the public ear of late months. The two principal offenders are the helicopter, which makes an unfamiliar sound in the centres of large cities, and the modern jet fighter. The latter has, in the unscientific but forceful words of a British acoustics engineer, "really caught us with our pants down"—by which he meant that present-day turbojets with five-figure thrusts and reheat can produce a power of sound literally hundreds of times greater than can almost any other noise source. In the air, such aircraft are bearable; either they fly high or they are gone within seconds. Ground running, however, is another matter.

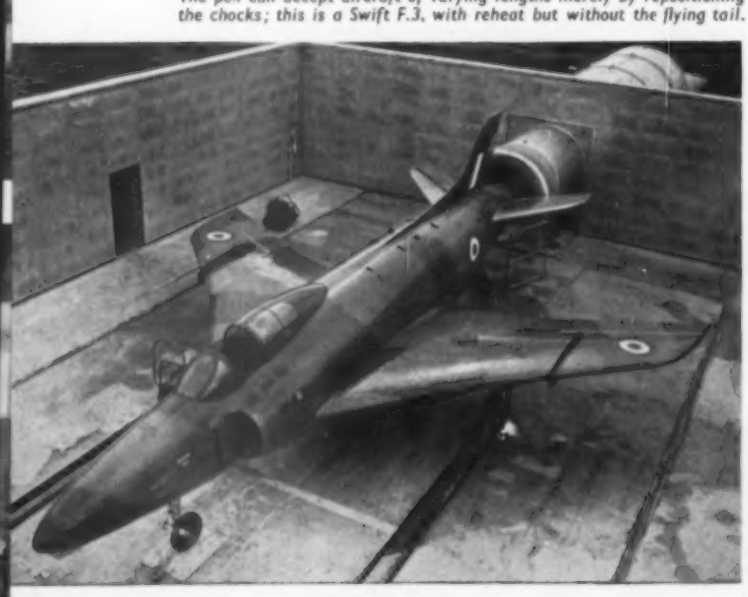
At South Marston, six or seven miles from the centre of Swindon, Wiltshire, the Supermarine division of Vickers-Armstrongs are building Swifts for the Royal Air Force. These aircraft are powered by the Rolls-Royce Avon with reheat, and each machine has to do a certain amount of running on the ground before delivery. At full power, the noise is absolutely shattering; it places an undue strain on those in the factory and offices, and has even had severe repercussions in the town of Swindon itself. Something had to be done, but it was clearly going to be more difficult to quieten a complete Swift than it is to subdue the sound of the bare engine at a Rolls-Royce factory.

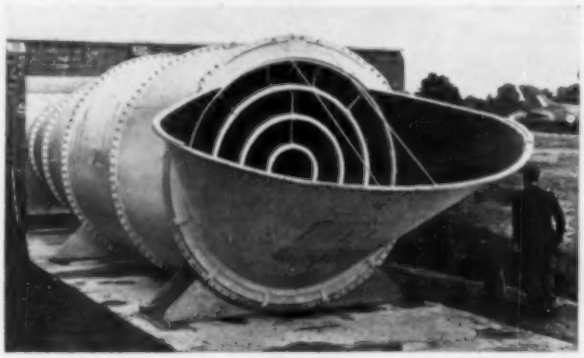
The resulting installation is shown in the two photographs. Although largely experimental it is extremely effective, and will undoubtedly be followed by many other similar structures. The Swift is pushed into a pen consisting of walls 12ft 6in high and lined with absorbent material, the location of the aircraft being determined by wheel channels. The jet nozzle is then centred in the bell-mouth of a short muffler (described below) by means of a ramp under the nosewheel, a pair of five-ton restraining wires attached to the rear fuselage, and large chocks pinned to the floor channels ahead of the main wheels. The front of the pen is then closed by means of a pair of massive, sound-absorbent sliding doors.

The walls of the pen incorporate shelters for the Rolls-Royce test crews and Supermarine engineers, and fire-fighting equipment is provided. The floor is completely clear, and clean, grit-free air for the Avon is drawn in over the walls.

The pen was designed by Mr. Quentin Reeves, a consulting engineer, and the muffler itself is a product of Detuners, Ltd., of London, N.19; an associated company—H. J. W. Cullum and Co. —was responsible for the acoustic lining of the pen. The muffler follows the principle of the well-known Detuner for test-beds (*Flight*, September 5th, 1952), but is, at 45ft, only about half as long. Known as the Cullum Muffler S/A, it consists of a mouth, venturi, two diffusing stages, static reactor, a central body to break up the core of the jet (moving at 1,700 m.p.h. with a temperature of 1,500 deg C during reheat), acoustic splitters and a final uptake, as shown above. Mild steel is the principal material, and cooling is effected solely by the air entrained around the bell-mouth.

The pen can accept aircraft of varying lengths merely by repositioning the chocks; this is a Swift F.3, with reheat but without the flying tail.





In a cross-wind it is possible to stand directly behind the Cullum Muffler and watch the operation of the Swift's afterburner.

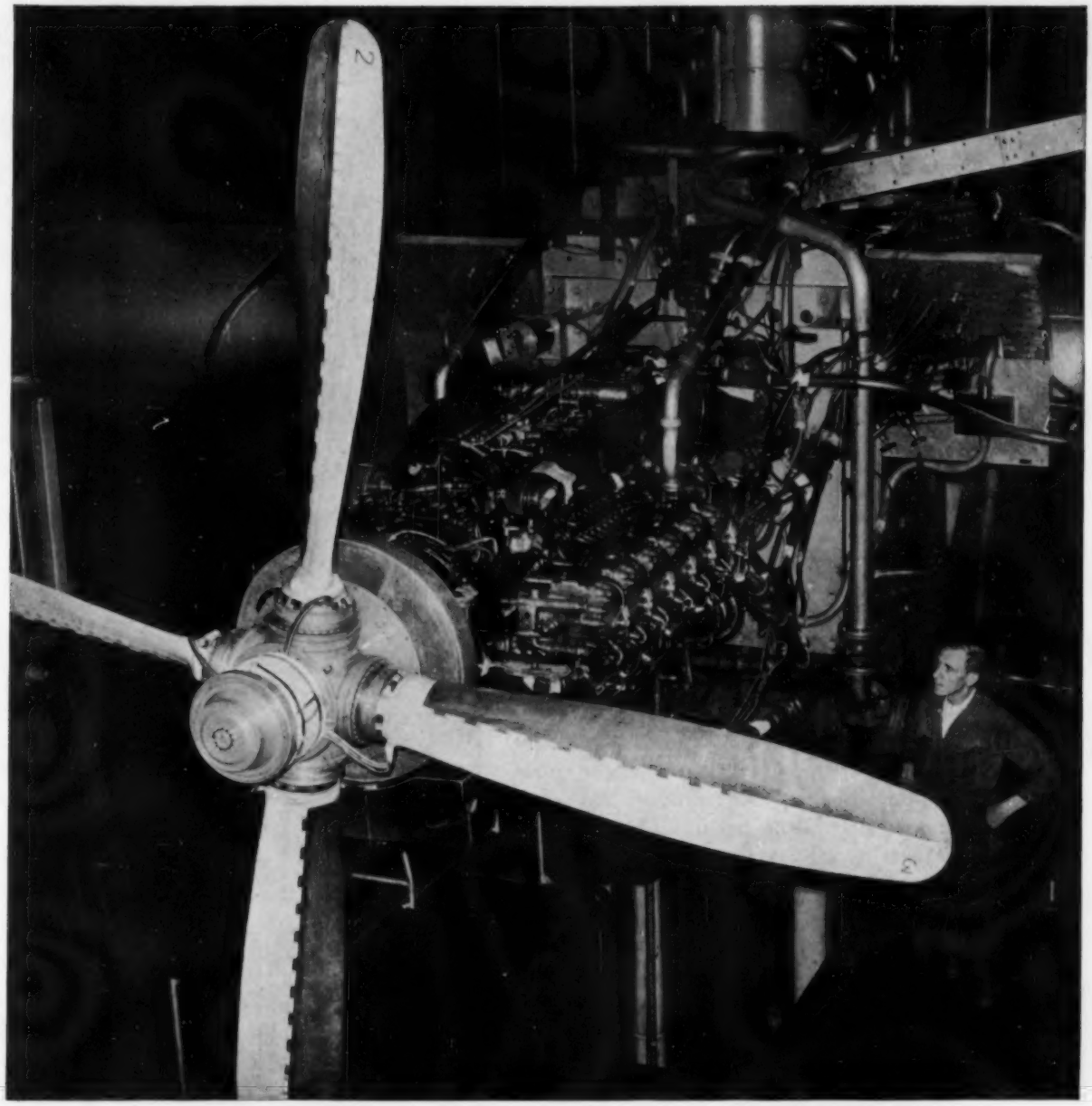
It is, in fact, the noise from the air gap around the bell-mouth —a persistent low-frequency sound of about 140 decibels—which has necessitated the provision of a pen; otherwise the muffler alone would have sufficed. During a reheat run, the noise on the port or starboard quarter at a distance of about 100ft is no less than 140-150 decibels—hundreds of thousands of times more intense than that produced by ordinary road traffic and several thousand times greater than the threshold of pain, normally taken to be 120 db (the decibel is a logarithmic unit). With the muffler and pen, the figure is reduced to about 102 db, which permits conversation; this represents a reduction in sound energy of more than 99 per cent.

The physiological effects of intense noise can be serious, particularly if it is endured for long periods. Apart from deafness, common symptoms are pains in the eyes, head, stomach and behind the knees, and an overwhelming feeling of tiredness, lassitude and giddiness. The crews actually inside the pen are partially protected by ear defenders, and the R.A.F. Institute of Aviation Medicine are continuing their research into the physiological condition of such personnel.

The installation at South Marston cost about £10,000. It was first used on September 16th, when a Swift F.2 (without an afterburner) was run up to full power. Supermarine state that "normal conversation was possible close to the muffler and the walls of the pen. After the tests, enquiries at the factory as to what noise had been heard brought mostly negative replies, and occasional disbelief that an aircraft engine had been tested at all." The following day a Swift F.3, with afterburner, was also run at full thrust, with equally encouraging results.

From now on, all ground running on Swifts at South Marston will be done in the acoustic pen. Runs will be spaced throughout the day, but a great deal will naturally take place early in the morning, in order to allow the aircraft to catch the best weather. South Marston is the first Swift plant to have such an installation, owing to the greater facilities there for research and experiment, but the company intend to provide a similar unit for Chilbolton and probably a second pen at South Marston. The main factory of Vickers-Armstrongs, at Weybridge, are developing a considerably larger and more elaborate structure, suitable for the Valiant.

Many readers will be aware of the fact that the noise from a turbojet can be greatly reduced by fitting a serrated, or saw-tooth, nozzle; this principle was outlined by Mr. F. B. Greatrex of Rolls-Royce in a recent R.Ae.S. paper. It is apparent that any advantages produced by this means are additive to those of the running-up pen and muffler. The only objection to a saw-tooth nozzle on the Swift appears to be the purely mechanical one of the difficulty of providing serrations on the moving eyelid shutters of a reheat turbojet. Nevertheless, there is no doubt whatever that noise from fighters is going to be a very great problem in the near future, and countermeasures are going to cost both manufacturers and operators—and the M.o.S.—a lot of money. Just what can be done to silence rocket motors is so far unknown; the only ameliorating factor in this case is that ground runs would usually be of very short duration.



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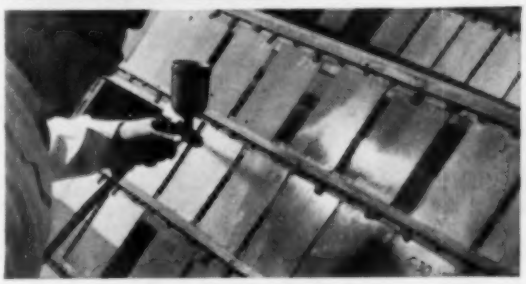

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HERE AND THERE

G.A.P.A.N. Quarter Century

WHEN the Guild of Air Pilots and Air Navigators celebrates its 25th annniversary on November 30th, the Grand Master, H.R.H. the Duke of Edinburgh, will preside over the ceremony. To be held at the County Hall, London, the celebration will include the installation of the new Master, wardens and assistants, the presentation of trophies and awards, and a reception.

Off to a New War

LAST month, when Pest Control, Ltd., finished their spraying operations against the pine-looper caterpillars in the forests of Cannock Chase and of Culbin, on the Moray Firth, they had distributed over 21,000 gallons of D.T.D. emulsion from the two Austers engaged. The pilots, Mr. Henry Johnson and Mr. John Jones, have now gone to the Sudan for a cotton-spraying operation.

North America's Radar Defence

CANADA and the U.S.A. have agreed on the construction of a third system of radar early warning stations, to be located along the northern fringe of North America. The U.S.A. will also construct stations in the sea to the east and west of the chain of radar stations on land. This will be the third radar chain that is to be built by the two countries. It is believed that the first line, near the border between Canada and the U.S.A., is now complete. A second line, near the 54th parallel of latitude, is under construction but will not be finished for several years.

Thunderstreaks For U.K.

LAST week a number of pilots of the U.S.A.F. 20th Fighter/Bomber Wing (H.Q. at Wethersfield, Essex) left their base at Bentwaters, Suffolk, to pick up a number of Republic F-84F Thunderstreak aircraft which had been shipped to a Continental port in a U.S. Navy carrier. These aircraft are Sapphire-powered developments of the Republic F-84G Thunderjet with which the wing is at present equipped. Compared with the earlier machine, the F model is fitted with a heavily swept wing of reduced span but larger chord, a swept tail, and has an all-up weight of some 25,000 lb. The aircraft is supersonic in a very shallow dive. A wide variety of weapons can be carried, including tactical atomic bombs.

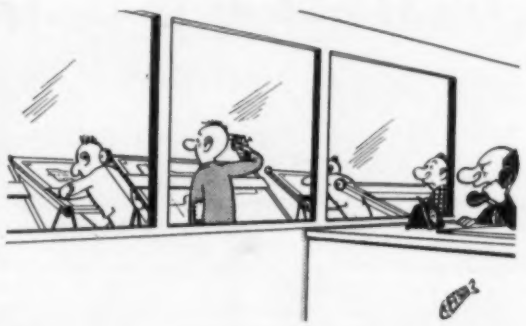
British I.R.E. President

THE council of the British Institution of Radio Engineers announces that Rear-Admiral Sir Philip Clarke, K.B.E., C.B., D.S.O., is to be their next president.

Oslo Shows the Way

AN architect and a contractor have sought advice from both American and British authorities on designing a helicopter platform for the top of a new 12-storey building in Oslo. This structure will be the first in Scandinavia to be so equipped. About 4,500 sq ft in area, the platform will stand well above roof-level and so will be clear of obstructions such as chimneys.

SENIOR PUPIL: A.V-M. T. N. McEvoy, Senior Instructor at the Imperial Defence College, is undergoing a course of helicopter flying instruction at the Westland School at Yeovil.



"Personnel? I shall require a new draughtsman rather urgently."

Hanna Reitsch's New Post

IT is reported from Western Germany that Hanna Reitsch is to become a test pilot with the Deutsche Versuchsanstalt Fur Luftfahrt (German Experimental Institute for Aeronautics) at Essen-Muelheim aerodrome. She was a Focke-Wulf test pilot before and during the war.

Initial Error

IN spite of B.E.A.'s initiative in starting new services, they are *not* operating Constellation 749As from Sydney in partnership with Qantas: in a recent news-item concerning Sir Hudson Fysh and Qantas plans, "B.E.A." should, of course, have read "B.O.A.C."

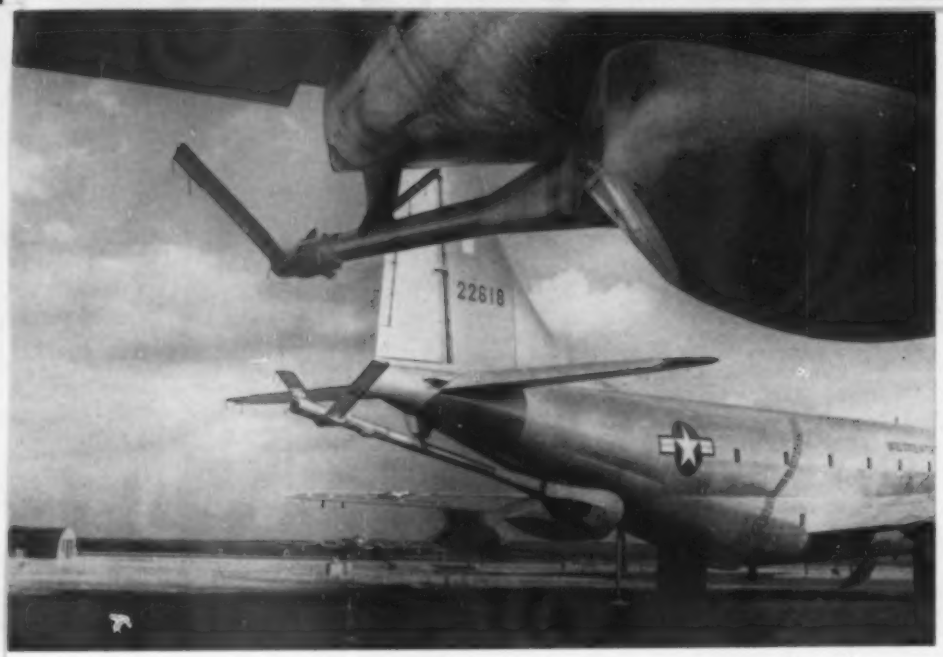
Radar Association Meeting

ON Wednesday, October 13th, members of the Radar Association are to hear a talk on "The Decca Navigator, its Invention, Development and Future Possibilities," by G/C. E. Fennessey, O.B.E., and Mr. H. G. Hawker. The meeting will be in the Anatomy Theatre, University College, Gower Street, London, W.C.1.

Canadair's Cut-back

FOLLOWING cancellation of a $200m contract for T-33 trainers in June of last year, Canadair, Ltd., began to dismiss workers. At that time about 14,000 were employed; union officials say that over the past year the payroll has fallen to 6,000; a company source puts the figure at 9,000. It is thought that a number of workers will be recalled in the spring, when licence production of the Bristol Britannia begins.

TALKING ABOUT BRITANNIAS during a recent visit of directors of Airwork Ltd., to Bristol were (right to left), Mr. R. C. Benbow, Mr. R. L. Cumming and Sir Archibald P. Hope. In pensive mood is Bristol's Dr. A. E. Russell, and with his back to the camera is Mr. C. F. Uwins.



"Flight" photographs

Boeing KC-97G tanker/freighters, 22 of which equip the 43rd Air Refuelling Squadron of the 43rd Medium Bomb Wing now at Lakenheath, where "Flight" visited them. Major Jerry O. Spray (right) is the squadron commander.

"AVAILABLE JONES" ON DUTY

With the KC-97Gs of the 43rd Air Refuelling Squadron, Strategic Air Command

EVERY few months we hear that another Medium Bomb Wing of the U.S.A.F.'s Strategic Air Command has come to England for 90 days' temporary duty. The man in the street probably imagines the ponderous workings of military movement routine carefully planning the move months ahead and laying on all the thousand and one formalities which would normally encumber the displacement of a large military formation from one continent to another. Yet although the high-level decisions are probably made well in advance and the flights undoubtedly carefully flight-planned, the Medium Bomb Wings themselves are the most loose-footed formations in the world. They can and do simply strike camp and move off to another continent at a few hours' notice—and begin operations immediately they get there.

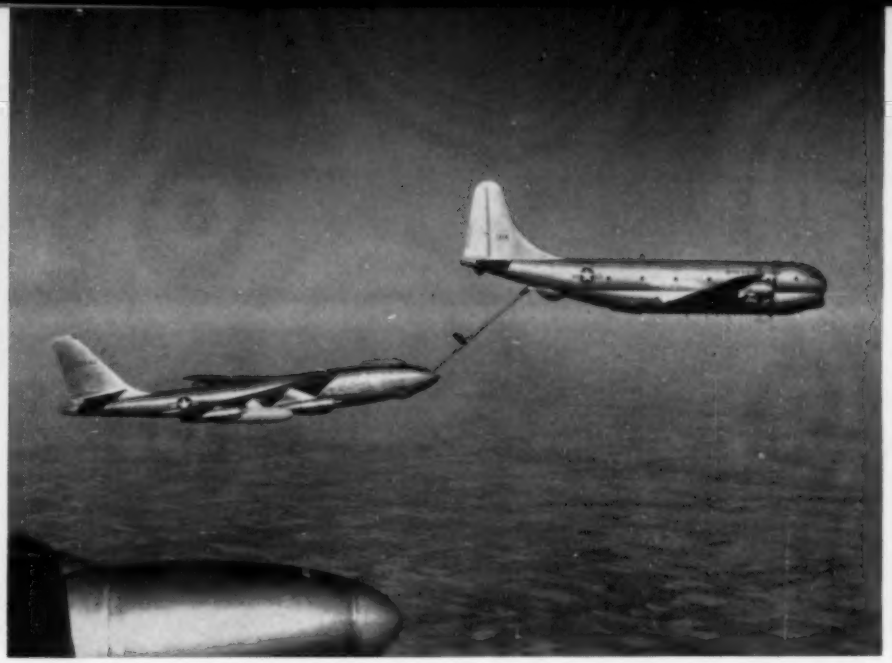
But in contrast with normal transatlantic ventures one hears very little about the actual operations of Strategic Air Command formations. Being at constant action-readiness they quite rightly keep their own counsel and go to some lengths to maintain a war-time security curtain between themselves and those who can have no reason for knowing about them. *Flight,* however, recently went to Lakenheath in Suffolk to visit the 43rd Air Refuelling Squadron (Maj. Jerry O. Spray) of the 43rd Medium Bomb Wing (Col. Burchinal) in order to see the key factor in the Command's global mobility concept—the KC-97 tankers and crews who fly them.

The KC-97G boom operator prone on his couch with his hand on the "ruddevator" control column. His companion is outside on the tarmac.

Having arranged the visit through a local U.S.A.F. headquarters, we duly presented ourselves at the entrance to Lakenheath airfield, wondering just what we should find. But before we could seek out anything, we were politely directed to the "Pass and registration office" whence, we soon realized, we could be retrieved only by the officer appointed to escort us. We were therefore shortly met by Capt. D. Deafenbaugh, in whose company (and no one else's) we were authorized to inspect the squadron. These remarks are neither frivolous nor disparaging. The security system is comprehensive and energetically observed by every officer and enlisted man in the Command; we were impressed in this respect, and in every other, by the air of very quiet but determined efficiency which was everywhere evident. It was in this security-conscious atmosphere that we pieced together the story of the use of the KC-97G in support of the B-47s.

The 43rd Air Refuelling Squadron is based at David Monthan A.F.B., Tucson, Arizona, and has behind it a long history of refuelling all over the world and with many different types of aircraft. It completed 90 days' temporary duty here early in 1953 and returned for a further tour at the beginning of September. Capt. Deafenbaugh himself had been in air refuelling since the early days, when the original Flight Refuelling, Ltd., gravity-feed loop-hose equipment was used between B-29s. This early equipment was followed by the pump-feed loop-hose system, the Boeing flying-boom gear (in KB-29s and then KC-97s) and, finally, the British probe and drogue. Capt. Deafenbaugh had used them all; he joined the 43rd Squadron some 2½ years ago. At present the boom gear is used almost exclusively, the main receivers being B-47s and F-84Gs. The 43rd had serviced the B-29 *Lucky Lady* on its non-stop round-the-world flight, providing three tankers for the job.

The Squadron, with 22 KC-97Gs (about the 420th to 440th production machines, some ten months old) is attached to the 43rd B-47 squadron in the 43rd Medium Bomb Wing. A KC-97G crew consists of an aircraft captain, a co-pilot, a navigator (all officers), an engineer, radio operator, and two boom operators (enlisted men, of whom the engineer is "the ranking man"). With them wherever they move they carry three ground-crew members, the whole team being attached to a particular aircraft. The



"Flight" photograph

Our guide and mentor at Lakenheath, Capt. D. Deafenbaugh, aircraft captain in the 43rd Squadron, standing by the nosewheel of his aircraft. On the right is seen the type of refuelling operation on which he is often engaged.

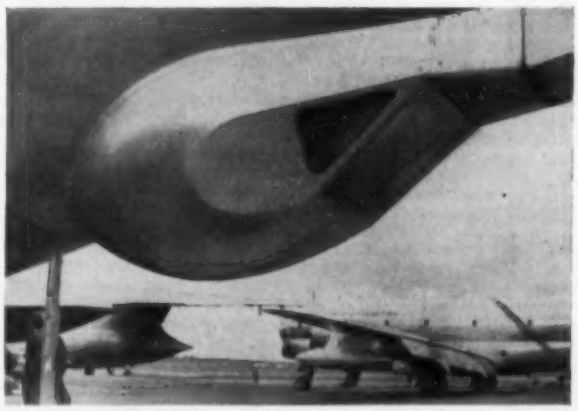
idea is that the crew goes on leave when the aircraft goes in for overhaul. This system is not hard and fast, but is applied wherever possible.

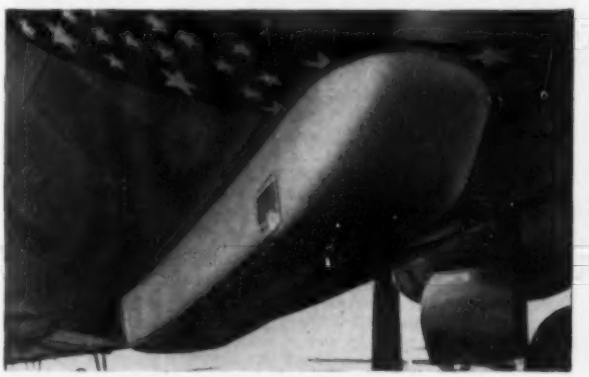
The main purpose of the KC-97Gs is flight refuelling, and for this they carry two tiers of fuel tanks on the port side of the upper deck, and four smaller tanks on the lower deck. In addition, the underwing tanks can be purged and used for flight refuelling when required. The total transferable fuel load was not divulged ("I am sorry, that's classified"). Nor was it possible to learn at what height and speed refuelling takes place. It is evident, however, that the B-47 has to leave its operational altitude to pick up fuel, and that the actual transfer takes place in very close formation in a gentle dive. It is quite a delicate operation in view of the changing c.g. in the receiving aircraft and the transfer of loads from tanker to receiver. The latter's pilot feels distinctly "tied" while in contact, but with a skilful boom-operator the tanker pilot is often unable to sense when contact is actually made.

The squadron flies some 500 hours a month, each aircraft making about two contacts per week. According to whether fuel is passed or not, contact is termed "wet" or "dry," but whatever the purpose of a particular flight, it is always planned as a load-carrying operation. Considerable care has to be taken in calculating range and endurance according to the point at which fuel transfer takes place, and if the contact is for some reason missed, the whole transferable fuel load can be jettisoned through the boom in a very short time. Endurance must always be carefully watched.

Great care has been taken by Boeings to provide every visual and electronic reference and facility for refuelling. Contact can be made by night or day, I.F.R. or V.F.R., using unspecified electronic equipment ("I'm sorry, that's classified, too"). Once visual contact is established, the receiver pilot lines up on a broad red stripe running the whole length of the KC-97's belly. The boom operator, lying on a bed in the pod, "flies" the boom with the "ruddevators" controlled by a horizontal joystick under the bed and which he holds with his right hand. With his left he controls two pistol-grip levers, one for the telescopic boom extension and the other for the winch which lowers and raises the boom Before him he has all the fuel controls and switches.

Although there are some 10 to 12 tanks of transferable fuel,





The position indicator panel under the KC-97G's belly and (upper view) the KC-97G boom operator's position from outside.

"Flight" photographs

(Left) The original boom installation in the KB-29. The boom is fully extended.

An "alert crew" typical of those which are at constant readiness for emergency refuelling requirements.

"Flight" photograph

"AVAILABLE JONES" ON DUTY . . .

they are so arranged that they feed almost automatically without causing a change of c.g. in the tanker. It is difficult for the operator to make a mistake and cause the pilot undue discomfort. Refuelling is done under manual control, since the object is to provide a steady platform for the receiver; the autopilot is considered too jerky for this purpose.

The boom-operator's position is comfortable and visibility is ample through slightly tinted windows. Since the aircraft is pressurized (cabin altitude 5,500ft at 25,000ft) he need wear no face mask, and even earphones are apparently unnnecessary, as each crew station has its own intercom loudspeaker.

The lower deck, split into two compartments by the carry-through structure of the wing, is entirely occupied by the fuel tanks, which, though they are removable, are normally left in position. Most of the upper deck floor space is completely free for additional cargo since the cylindrical tanks occupy only about a quarter of the fuselage width. There is a large freight loading door at the forward end of the upper deck to starboard and, if the aircraft is used for freight only, the whole boom and refuelling pod can be dropped out and replaced by clamshell doors. Vehicles can then be driven up a ramp, or freight lifted straight out of a truck driven under the tail, and deposited where required by a roof gantry. This gantry can also be used for dropping parachuted stores overboard in flight. Main crew and passenger access to the aircraft is by two doors on the port side of the lower deck, one ahead and the other aft of the wing. These doors drop downwards on compensating cables and have built-in steps. The upper deck is reached by ladder through a hatchway. The two-cylinder stand-by generator motor is mounted close to the forward access door.

The flight deck itself, in which five of the crew work, is a model of what such places should be. Navigator's and radio operator's stations are spacious and well equipped, and completely clear separate passageways lead to each pilot's seat; pilots' and engineer's stations are so arranged (the engineer faces to starboard) that all three can reach and see any of the controls ranged on roof panels, upright panels and on the central control console. Both wing tips are easily visible from either pilot's position and the view ahead is, of course, completely unobstructed, with extra windows above and below the windscreen for downward and upward vision. The pilots have about five instruments apiece to look at and they have the most comfortable adjustable seats we have yet seen for pilots of military aircraft. The crews wear extensively zippered overalls, padded, fur-collared jackets and those long peaked close-fitting caps which have become a U.S.A.F. trade mark.

If desired during night refuelling, almost the entire aircraft can be illuminated from outside; four flush-mounted blue lights in each wing upper surface can be used as a formation flying guide, and navigation lights (normally flashing) can be switched to steady to prevent distraction. The boom itself can also be illuminated. A long panel under the fuselage contains six signs, "forward," "backward," "left," "right," "up" and "down." These signs are turned on by micro-switches at the base of the boom so that as its movement-limits are approached the signs automatically warn the receiver pilot to adjust his position. Finally, there are three lights in the KC-97's nose: one red warning light, one fixed taxi light and a second taxying light which swivels with the nose-wheel gear. All the 43rd Squadron aircraft bear a slanting star-spangled blue stripe around the fuselage which, we learned, is the insignia of the Strategic Air Command.

At any time of the day or night at least one KC-97G is ready to take off at a moment's notice should a B-47 require fuel. Both over here on "T.D.Y." (temporary duty) and at the home base in Arizona a continuous training programme is carried out. As stated, about two contracts per week per aircraft are made and missions flown under all load conditions, sometimes taking advantage of the considerable maximum endurance of the aircraft. Boeing reports "a maximum all-up-weight of 175,000 lb and a disposable load for early marks of KC-97 of up to 30,000 lb," which indicates that the KC-97G's transferable fuel load must be in the region of 3,000 gallons.

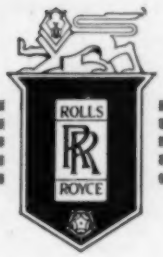
Amongst the crews, some of the pilots are newly trained while others are what the U.S.A.F. terms "old heads," or old-timers; the average flying hours of an aircraft captain on the squadron are between 2,700 and 3,000. Maj. Spray rightly refused to detail the procedure employed in moving the wing across the Atlantic, but about the technique in general he said that contact could be made in almost any weather and even without the use of R/T. communication. Each boom operator has to qualify separately for each type of receiver, but most of the 43rd Squadron's boom operators are capable of dealing with any type of air-refuelled aircraft in S.A.C.

The 43rd Medium Bomb Wing is not at Lakenheath, although several B-47s were to be seen during our visit doing G.C.A. approaches and overshoots. When the wing moves, wives, homes and relations are left behind; for three months or possibly longer the wing settles at a U.S.A.F. base abroad and operates completely independently. Nearly all maintenance is carried out by personnel who have travelled with the wing; the bases themselves are run by special units. Life in the Strategic Air Command is no sinecure, but the result is a fighting force whose striking potential is unequalled. Its effectiveness can be gauged when one remembers that, at the beginning of the Korean war, wings of comparatively slow B-29s moved from America to Japan and began active operations some three or four days after first being ordered to move. With the vastly increased performance afforded by the B-47 the striking speed of S.A.C. has been considerably increased. Its reach has also been lengthened by the KC-97G—of which, Maj. Spray remarked, the crews are genuinely proud.

THE F-86K SABRE

ORIGINALLY developed by North American Aviation for production by Fiat, in Turin (against M.D.A.P. funds) the F-86K has now flown. A variant of the F-86D all-weather fighter, and externally almost identical with the latest production Ds, the K has an armament of four 20 mm cannon in place of the original belly tray of rockets. No doubt these cannon are of the completely new Ford-Pontiac M39 type, or possibly of the even later "Project Vulcan" multi-barrel form. Associated with these guns is a new fire-control system, developed by North American.

Moving the armament forward has required an eight-inch extension to the fuselage, to preserve the c. of g. location. Other changes include incorporation of the tail and landing gear of the heavier F-86H. The engine remains an afterburning J47—actually the J47-GE-33. The new F-86K is now built in both America and Italy, the initial Fiat aircraft being made of American components.



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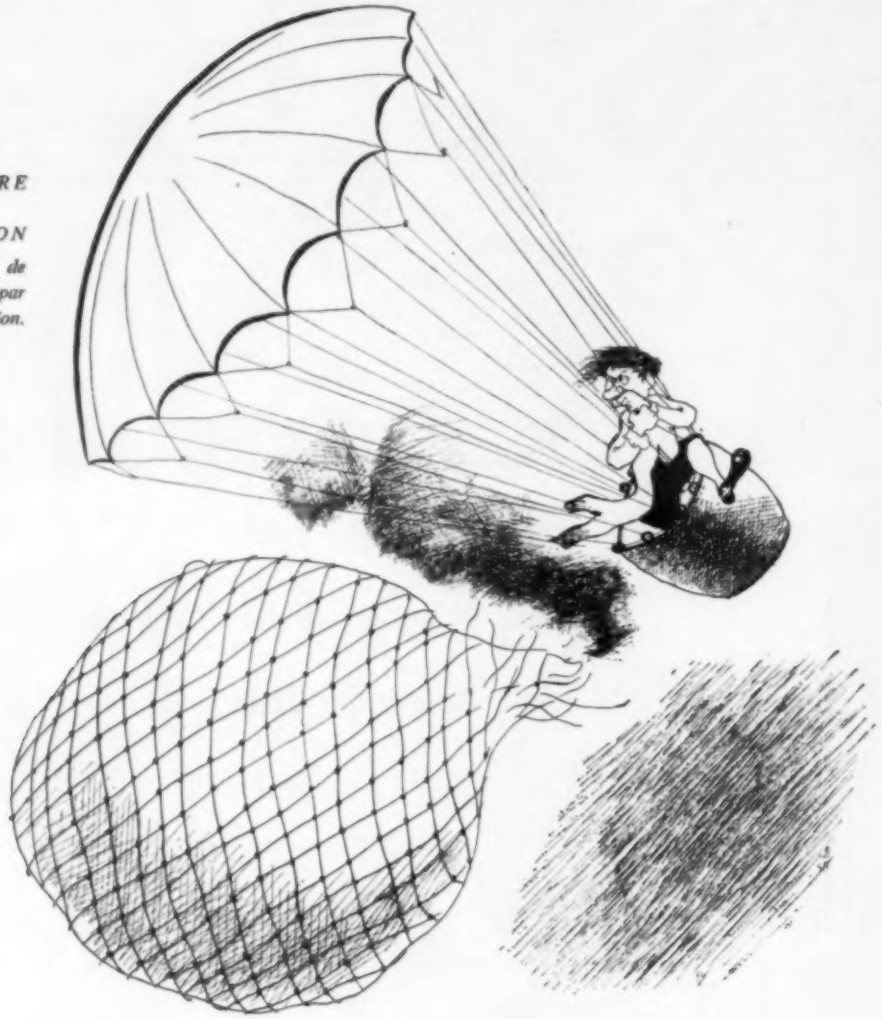

GARNERIN'S PARACHUTE

ANDRÉ-JACQUES GARNERIN, Commissaire of the armies of the Revolution, was captured at Marchiennes, deported to Hungary and imprisoned at Budapest. For years he plotted and planned his escape and eventually he won his freedom via a prison sewer. Back in Paris with the notebooks written during his captivity he immediately set to work to fashion a balloon, a strange apparatus capable of supporting a human being.

At last his work was completed. The scene of the first trials was the park of Monceau, and there, at five o'clock one fine evening, Garnerin ascended swiftly before the enthralled gaze of the promenaders. The balloon climbed to a height of one thousand metres and then, to the crowd's horror, exploded with a bang. Garnerin plunged earthwards and seemed lost. But suddenly the balloonist's rate of descent was checked: a great canvas sheet opened above him and he was seen to be clinging desperately to the ropes suspended from the contraption.

After a swirling, bucketing ride he landed without injury among the spectators and received a wonderful ovation; and the astronomer Lalande, who had assisted in the dangerous experiment, dashed off to announce the spectacular success of the parachute to the National Institute of Science. It is claimed that on the way he thought up the idea of controlling the descent of the parachute by means of a hole in the middle of the fabric.

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LOW-SPEED AERODYNAMICS

—*and Model Aircraft Techniques: the First L.S.A.R.A. Conference*

BETWEEN the hobby of aeromodelling and the serious business of aerodynamic research and radio control development, a wide gap might reasonably be assumed. The work of the Low-speed Aerodynamics Research Association has for a number of years been directed to applying an interchange of techniques between full-scale and model investigations: the Association's degree of success was clearly indicated at its first all-day conference held at the Royal Aeronautical Society on September 25th.

The history and work of the Association were first outlined in the morning session by Mr. N. K. Walker, B.Sc. (R.A.E., Farnborough), a founder-member and the director of research. The Association's members, who numbered about 100, were mainly of University age, i.e., at the stage when their enthusiasm for modelling was changing to an interest in full-scale aircraft methods, and their work had three separate aspects. Firstly, there was an educational programme in which full-scale aircraft techniques were applied to models; secondly, aerodynamic research work at low Reynolds numbers was performed on model aircraft, together with work on power plants; and thirdly, there was the application of model techniques to full-scale aircraft.

The work of L.S.A.R.A. members had at first been performed independently; subsequently, work for outside firms and the Ministry of Supply, and research sponsored by the Association itself, had also been carried out. The scale of research had progressively increased; one example was the flight control project in which radio control test and development work was being performed, under Government contract, in association with Murphy Radio. Annual expenditure had increased from £10 in 1947 to £600 in 1953-54.

Mr. H. B. Irving, B.Sc., F.R.Ae.S., president of the Association and previously Assistant Director of Scientific Research (Air) at the Ministry of Supply, next introduced the first of the technical papers. Its subject was the dynamic scale free-flight model, and it was given by Mr. W. A. Crago, of Saunders-Roe.

The use of dynamic models in the development of full-scale aircraft was described by Mr. Crago in an account of his company's work in this field on sea-based aircraft. After mentioning early work by R.A.E. and the American Consolidated Vultee company, and the acceptance of a correlation between the behaviour of dynamic models and full-scale aircraft, he went on to outline the "principles of dynamicism."

After describing the method of construction of dynamic models, the speaker suggested a span of approximately 8ft as an optimum size. Longitudinal stability could be studied in a towing tank, while the use of a free-launching tank gave comprehensive information on all stability aspects. Radio control was certainly an asset, especially for self-propelled free take-off tests, but the weight limitations were severe.

Mr. Crago next showed a colour film of landing and take-off investigations on a model of a Saunders-Roe hydro-ski fighter. Finally, he demonstrated the form of propulsion used by starting up a small rocket motor, using high-test peroxide, which provided a 10 lb thrust for 30 seconds at a weight of only 5 lb.

Mr. D. W. Allan, of the R.A.E., presenting the next paper, gave an account of the development of the L.S.A.R.A. multi-channel proportional-control radio link. The design of this equipment had been suggested by Sir Harold Roxbee Cox in 1945, as an alternative to the American set—costing $25,000 and weighing between 21 and 30 lb—used in dynamic models of flying-boats by the Consolidated Vultee Corporation. The Association's work on this began in 1947 and flight testing had started in 1951.

The radio-control receiver was based on the systems used in the German glider bombs, with modifications to reduce the weight and size of the equipment. The Murphy production-type four-channel receiver measured 3½in diameter by 4½in long, and weighed only 1 lb. Associated airborne equipment consisted of a four-channel servo amplifier, the voltage-following position servo units and a servo switch, while the standard ground equipment comprised a 25-lb transmitter, a control box and a 24-volt aircraft battery. The control box carried a miniature control column giving aileron and elevator deflection by appropriate movement, and also a rudder control knob and three trimmers.

After describing the equipment and explaining the basic principles of its operation, Mr. Allen gave details (illustrated by a colour film) of flight experience gained. Under M.o.S. contract, a series of successful flights had been made, using a glider test vehicle weighing 14 lb, later powered by a petrol engine developing 1½ h.p., and by a larger machine weighing 110 lb, and powered by a 6 h.p. engine. One practical point which had arisen during flight tests was that the servos should be fast enough to enable the pilot to damp out the phugoid pitching oscillation.

The next paper contributed by F. W. Schmitz (one of the first men to make accurate low Reynolds number tests on model aerofoils), was read in summarized form by Mr. Walker. It concerned turbulence effects on flying models, and included results concerning the effect of a wire placed ahead of the leading edge in order to induce turbulence and so delay flow separation over the wing.

Low-speed Aerodynamics and Scale Effect was the subject next discussed by Mr. R. W. Annenberg (Air Trainers, Ltd.). The two main cases in which model techniques could assist in full-scale research, he stated, were those involving non-linear motion and unsteady motion. Seaplane and flying-boat tests, and work in spinning tunnels, were two important applications. The speaker went on to discuss the experimental work done by Schmitz and in particular the various possible methods of introducing turbulence and delaying separation.

The afternoon session, devoted to the application of full-scale theory and techniques to model aircraft design, began with a second paper by Mr. Annenberg, entitled *Introduction to Aerofoil Characteristics at Low Reynolds Numbers*. The speaker considered first the problem of achieving maximum gliding performance from a given height, and went on to outline the significant factors in a study of aerofoil characteristics. The changes in the transitional region of flow over aerofoils under various conditions were illustrated by graphs, and the corresponding changes in the lift-curve slope were discussed.

The work of the Model Aerodynamics Research Project, an associated *ad hoc* group, was described next in a report by Mr. R. F. A. Keating, of Battersea Polytechnic. Using a relatively simple wind tunnel, a large selection of data on a number of aerofoils had been recorded, and the main trends obtained—together with representative figures—were outlined by the speaker.

Vertical climb models were the next subject of interest. Mr. T. W. Smith (English Electric) gave an account of their development. As vertical climb—not vertical take-off—was the object, the models illustrated were basically high-thrust developments of what might be termed conventional types, and did not include any bedsteads. For *Flight's* representative at least, however, the names of the models certainly made up for any lack of novelty in design: they included *Witches' Broom, Scalded Cat, Burnt Toast, Scrambled Egg, Flaming Onion* ("had a hard life, but was beginning a trend"), *Toasted Crumpet* ("a scaled-up *Scrambled Egg*"), *Fried Fritter, Tattered Fratter*, and *Buttered Bun*.

Two further papers were presented: *The Development of the Ducted Rocket Power Unit for Models*, by A. A. Judge (read by P. R. Wayne), and *Model Engine Tests*, by P. G. F. Chinn (read by N. K. Walker). Before the meeting closed (well after the scheduled time), it was decided by the members present that the conference should become an annual event. Certainly, the variety of topics discussed was wide and the technical quality of the papers was high at this, the first such conference. A further indication of the scope and quality of the Association's work in general is given by its list of 50 published reports: further information on L.S.A.R.A. activities may be obtained from the secretary at 273 Farnborough Road, Farnborough, Hants.

U.S. BOUQUETS

OUR American contemporary *Aviation Week* recently paid a gracious tribute to British test pilots. S.B.A.C. Show crowds, it said, "were treated to an incredible demonstration of British guts and flying skill. Despite ceilings ranging from 500 to 700ft and a drizzling to drenching rain, pilots of all but a few aircraft put them through their paces. The planes were controlled by ground radar with only one allowed in the air at a time." Roly Falk, Neville Duke, and Dave Morgan were mentioned by name.

Another American tribute following the S.B.A.C. Exhibition came from the Washington *Evening Star*, which observes in a leading article "that British commercial and fighting planes are among the world's best"—and later that "the British aircraft industry has demonstrated rather impressively that British talents at design, engineering and manufacturing are being constructively employed. Research and experimentation in Britain has contributed some powerful weapons—from tiny supersonic fighters to giant multiple-jet bombers—to the defence arsenal of the Western alliance."

RADIO AND ECONOMICS

—in Aircraft Operation: America's Stanford Research Laboratories Study Installation Penalties

By JOHN GRINDROD, B.A. (Com.)

Three of S.R.I.'s model-pattern measurement towers above the rooftops of the Menlo Park, California, laboratories.

RESPONSIBLE for an important part in the development of aircraft electronics in the United States during the last decade has been the Stanford Research Institute, of Stanford, California, an industrial research centre with which many large American firms are associated. Having a staff of more than 100 engineers, physicists, mathematicians and technicians with a wide experience in communications, navigation, microwaves and other airborne appliances, the Radio Systems Laboratories of the Institute undertake investigation ranging from basic research into electromagnetic radiation to the design and construction of service test models of new types of radio equipment for both communication and navigation. To date, the Institute claims to have designed all or part of the radio systems for 26 types of civil and military aircraft.

It has been estimated that the advances made in aviation electronics in the United States since the early part of the Second World War have been almost directly proportional to the increase in the number of civil and military aeroplanes in use—from 23,000 aircraft in 1941 to some 127,000 in 1953. In the early 1940s the primary navigational aid to *en route* flying was the low-frequency, four-course radio range, of which about 200 were in operation on U.S. domestic air routes. No instrument-landing system was available for normal operations. So extensively have navigational aids been developed that, at the present time, there are 375 V.H.F. omni-directional range stations and 141 electronic instrument landing systems in operation at United States airports. To make a more recent comparison, covering the post-war period, in 1946 some 67,000 instrument approaches were made to United States domestic airports; in 1952, the number was 330,000.

With still higher operating speeds, increased air-cargo transportation, all-weather flying, short-haul operation and the adoption of new aircraft types such as the helicopter and convertiplane, aviation electronics can be expected to develop at an even faster pace.

The rapid development of these aids to navigation and communications has, of course, brought in its train a number of problems. Not the least of these is the initial cost of the equipment, and its working and maintenance costs in relation to the economics of aircraft operation. This is one of the many subjects investigated by the Stanford Research Institute.

According to their estimates, the total capital investment for civil aircraft electronic equipment per aircraft before the Second World War was about $4,000 (£1,429 at present rate of exchange). Pre-war fighters carried about $3,000 (£1,071) worth of electronic equipment, while bombers had about $5,000 (£1,786) worth installed. Today, capital investment for radio equipment on a DC-6 is roughly $30,000 (£10,710). On high-performance military fighters the figure is nearer $300,000 (£107,100), while on jet bombers the cost runs as high as $750,000 (£267,860).

To these high initial costs must be increased aircraft operating costs as a result of the weight penalties imposed by the equipment, and even of aerodynamic drag caused by aerial systems.

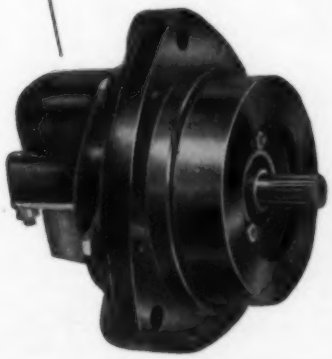
For instance, S.R.I. give the installed weight of the electronic equipment on a Boeing Model 377 Stratocruiser as about 800 lb. On the premise that a pound of payload on a B-377 is worth about $5.00 (35s 9d) per aircraft per year * the radio gear on this particular aircraft displaces potential payload to the tune of some $4,000 (£1,429) each year.

Since the addition of one pound to the weight of a high-

**This apparently very conservative estimate was quoted to the S.R.I. by a major airline; it is almost certainly a net profit figure.*

(Left) Equipping a model helicopter—it bears a marked resemblance to the Piasecki Work-horse—for the investigation of rotor-blade modulation effects on a V.H.F. navigation aid. (Right) A miniature receiver is installed in a strictly utility model of a supersonic delta.

Yesterday he was in London (Ontario)



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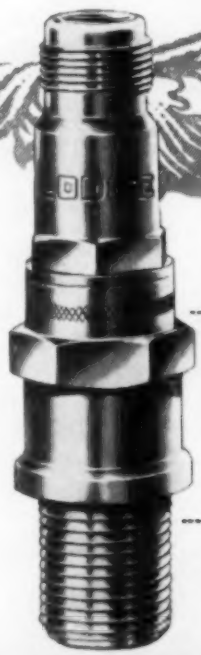

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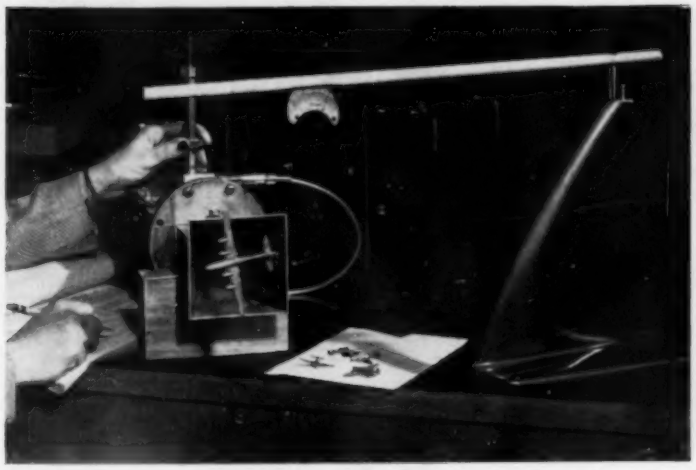


(Left) Studying electrical resonance phenomena: the B-29 model is suspended in front of a wave guide; microwave radiation from the mouth of the horn is reflected back to the waveguide, producing an interference pattern from which the nature of the resonance can be recognised. (Right) the "lion-tamer" is measuring antenna sensitivity on a B-47 model in an electrostatic field created within the cage.

RADIO AND ECONOMICS . . .

performance aircraft results in an increase of between eight and nine pounds in gross take-off weight, increased horsepower is needed to maintain the same performance. This in turn requires additional fuel and oil—a further factor in the weight problem. At the same time operating range and speed are affected. These negative factors, S.R.I. estimates, are sufficient to bring weight penalty of the Stratocruiser's radio equipment to about $17,000 (£6,071) a year.

S.R.I.'s radio laboratories have accordingly given a good deal of thought to the radio weight-factor. One of the avenues of research investigated has covered the possible use of equipment with only one voice-signal sideband instead of the high-power carrier signal with voice sidebands on each side, as produced by conventional amplitude-modulating systems. Since it is economical of radio spectrum and many times more efficient than conventional methods in the converting of prime power it is thought that this technique is well suited to aircraft. The high-frequency spectrum between 2 mc/s and 30 mc/s will accommodate at least twice as many single-sideband signals as can be utilized with double-sideband equipment.

A primary source of layload loss investigated by S.R.I. has been that due to the drag of external aerials or, to use the American term, antennæ. For instance, it is estimated that on a DC-6 cruising at 290 m.p.h. at an 18,000-ft altitude, the antennæ drag is about 76 lb. This represents 59 h.p. from the engines. Were all antennæ on the DC-6 to be flush-mounted it has been estimated that the cruising speed at altitude would be increased by 1.4 per cent. Other factors being equal, this would reduce route flying time, and, correspondingly, the cost of aircraft, fuel, oil, maintenance and crew by approximately $4,000 (£1,429) per aircraft per annum. In addition, the saving in aircraft use would amount to some 32 flight-hours for each machine. Such flight saving could be represented by five round trips between New York and Chicago.

Research in the S.R.I. laboratories has indicated that all communication and navigation antennæ can be flush-mounted on any airframe, though many factors have to be taken into consideration. They include radiation pattern, impedance characteristics and dielectric loss, precipitation static, and corona and breakdown voltage.

Much of the effort of the laboratories has been directed towards increasing the reliability of aircraft radio systems, especially by improved operational techniques and more efficient use of the frequency spectrum. Systems as a whole are studied to ensure the compatibility of each individual part.

Flight conditions are simulated extensively. This not only cuts down the expense of many actual flying hours but overcomes many practical difficulties, such as that of building antenna systems into completed airframes, especially if several locations for the antenna must be flight-tested. Model aircraft are, of course, used and linear measurements of the aircraft and the wavelength of the radio frequency used are scaled down in the same proportion. For instance, S.R.I. has seven model pattern ranges which are used to measure the radiation pattern of antennæ operating at frequencies higher than two megacycles.

Each model aircraft is mounted on a tower designed so as to have negligible effect on the field surrounding the model, and can be rotated in any direction with respect to the transmitted field. Usually installed in the model is a small receiver, and the demodulated audio signal is amplified to control the radial motions of a recorder pen. The circular motion of the table under the pen is synchronized with either the model or tower rotation. As the model rotates a plot of the signal is obtained.

Special techniques have been evolved for measuring radiation patterns at lower frequencies, where antennæ operate at wavelengths that are large relative to airframe dimensions. For instance, one of these methods makes use of electrostatic fields to simulate low frequency fields. By placing the model aircraft in a D.C. field between the plates of a large capacitor the sensitivity of Loran or A.D.F. antennæ is measured by the charge induced on the antenna as indicated by a calibrated electrometer, this charge being proportional to the antenna terminal current. The antenna radiation pattern is obtained by repeating the measurement at various aircraft headings.

For studying A.D.F. loop antennæ a uniform current-flow is produced in a large electrolytic tank by applying an audio-frequency voltage between two opposite conducting faces. A non-conducting model placed in the tank creates the same distortion as a full-scale conducting aircraft in the field of an electromagnetic wave. The amplitude and direction of the field near the model are measured by using a balanced voltage probe.

AUSTRALIAN DEFENCE DEVELOPMENTS

THE Australian Minister for Air, Mr. Townley, said recently that Service and aircraft experts are "soon to be sent abroad" to study the latest aeronautical developments with the idea of keeping the R.A.A.F. up to world standards.

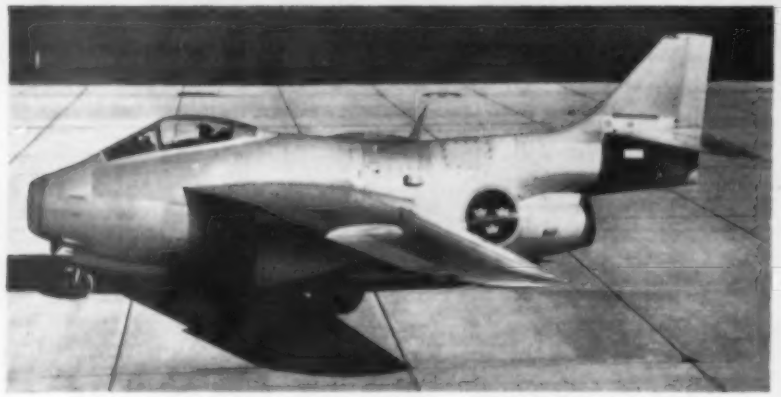
The Minister had flown to Brisbane from Launceston in a Canberra, which covered the 900 miles in less than two hours. Mr. Townley said this flight had convinced him of the wisdom of Australia's air defence policy; it had proved to him that jet aircraft could be scattered over the country and yet be concentrated at any danger point within a few hours.

Under the scheme announced by Mr. Townley, an Australian mission will leave shortly to spend six months in Britain, studying airframe design and engines. In addition, three Australian pilots are to be sent to Britain for intensive training.

Important air-base developments have also been announced by Mr. Townley. The Government is to spend a quarter of a million pounds to concrete Jackson airstrip at Port Moresby. Additional runways are to be built at Darwin and Manus Island airfields and a big new operations building is to be erected at Darwin.

The Minister also said that the chain of long-range bases—to be completed soon—would enable Australia to guard its seaways up to 3,000 miles from the coast in any direction at short notice. The chain would begin at Learce, in South-west Australia. An airfield at Learmonth on the West coast would provide a base for patrolling the south-central part of the Indian Ocean. Other air force bases would be set up in the Cocos Islands, some 2,100 miles north-west of Perth. Airfields capable of handling the heaviest aircraft now in existence have been built on the east coast, including one at Townsville, in north-east Queensland, which cost A£1,400,000.

AIRCRAFT INTELLIGENCE



This photograph shows the fourth major variant of the Saab-29, which basic type now equips most of the offensive units of the Royal Swedish Air Force. Styled J29F, the new machine has a wing with an extended outer leading edge, and the Ghost engine is equipped with a Swedish afterburner.

Great Britain

English Electric P.1. Although the prototype of this supersonic intercepter series is powered with a pair of Armstrong Siddeley Sapphires (it cannot yet be revealed whether or not these engines have reheat), the Italian journal *Alata* announces that later types of P.1 will be powered by Rolls-Royce Avons with "a high-efficiency form of afterburning." Another overseas journal, the French *Aviation Magazine*, comments on the striking similarity of some of the basic features of the P.1 and the S.N.C.A.S.E. Grognard, the latter having been—in the French publication's words—"stupidly abandoned." The report goes on to note that, whereas the Grognard carried its military load in the fuselage, the P.1 will mount its *engin anti-avions* (air-to-air missiles) beneath the wings.

Hawker Hunter Serials. For the record, the following are some of the serial numbers carried by Hawker Hunters: first prototype, WB188; second prototype, WB195; prototype Mk 2 (Sapphire), WB202; production Mk 1s, WT555 onwards (WT631 was exhibited at the S.B.A.C. Show); production Mk 2s, WN900 *et seq* (WN909 which was also at the Show), and "Hunter variant" (sometimes called Hunter 6), XF833.

All-up weights. Some approximate figures for the weights of various British aircraft are given in a recent issue of *Interavia*. Among them are the values of 24,000 lb for the Wyvern, 45,000 lb for the Canberra B.2 and empty and gross weights of 17,000 and 32,000 lb for the projected English Electric transport with a Double Mamba, the latter machine having the remarkable reported payload of 10,000 lb.

U.S.A.

Bell V.T.O. It has long been known that Bell Aircraft Corporation have, at their Buffalo plant, been developing a turbojet vertical-take-off machine for the U.S. Air Force; Ryan are doing similar work. The Lockheed and Convair machines already flown are driven by turboprops and are for the Navy. The Bell design is reported to have "multiple turbojets attached to the wing," so arranged that their thrust axes can be tilted vertically downwards for hovering flight, take-off and landing, and then returned almost to horizontal for forward flight. The Bell design is reported to be fully skinned and to look quite similar to conventional fixed-wing machines. (A flyable prototype was destroyed by engine fire on the ground, and it is the second Bell V.T.O. which is now reported to have flown.) *Aviation Week*, incidentally, in reporting upon recent British developments, claims that the Rolls-Royce test-bed only represents a stage of development reached by the N.A.C.A. two years ago in trials at Langley Field.

Boeing 717. This is to be the designation of the production development of the Boeing 707 jet-transport prototype, now on order for the U.S.A.F. It is reported that the 717 will be a heavier and more powerful machine than the prototype, with an all-up weight greater than 200,000 lb and powered by four turbojets of some 15,000 lb thrust—either Wright J67s or Pratt and Whitney J75s. Between 40 and 88 are stated to be on order, the majority being equipped for conversion to aerial tanking and flight refuelling. Boeing are also likely to receive an order for a similar type of machine from the U.S. Navy, who would find a fast, long-range aircraft of this kind very useful in the transport of urgent spares or personnel to all parts of the globe.

Cessna XL-19C. The first turboprop light aircraft was the Cessna XL-19B Bird Dog, first illustrated in this journal on November 21st, 1952. This machine was experimentally fitted with a Boeing 502-8 engine, delivering a maximum power of 175 h.p. (210 h.p. for take-off). The XL-19C has now been flying for some weeks, powered by a Continental XT51-T-1 turbine giving 235 h.p. and no less than 280 h.p. for take-off. The T51 is the Americanized version of the Turboméca Artouste; it is also fitted in the Sikorsky H-39 helicopter. Both the turboprop Bird Dogs are being used for general familiarization work with the U.S. Army at Fort Eustis, Virginia.

FOLLAND Fo.139 MIDGE
(Armstrong Siddeley Viper ASV.101 of about 1,400 lb thrust)

Span	20ft 8in
Length	28ft 9in

Air Power at Sea

H.M.S. THESEUS

In the records of the names of British warships H.M.S. *Theseus* appears three times: first as a third-rate commissioned in 1786, most recently as the light fleet carrier *Theseus* of 13,350 tons launched in 1944. Commissioned in peace, this ship yet has a history of action as one of Britain's principal naval units engaged in the Korean war. In the support of ground formations her aircraft, including squadrons of Fairey Fireflies, flew 3,446 operational sorties and made 4,594 deck landings, maintaining a standard of efficiency in carrier operation seldom equalled. Her reconnaissance aircraft (mainly Fairey Fireflies) covered 23,492,730 square miles.

H.M.S. *Theseus* represents a class of carrier which will, in the near future, operate Gannets, the Royal Navy's latest and most powerful anti-submarine aircraft designed and built by Fairey.

Crown copyright of the badge of H.M.S. Theseus is reserved and reproduction is made by permission of the Admiralty and H.M. Stationery Office.

FAIREY

Powered by an Armstrong Siddeley "Double Mamba"

GANNET

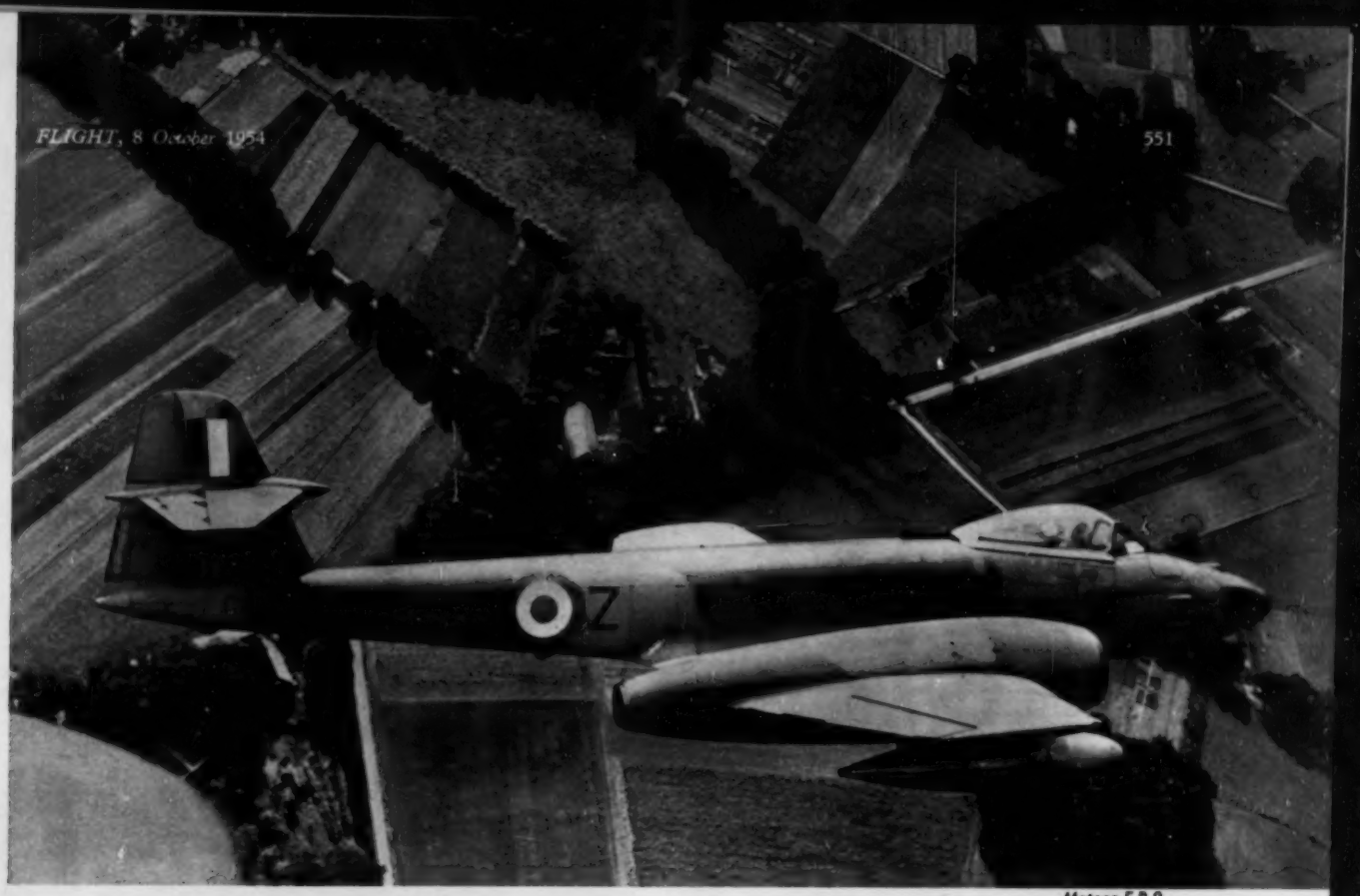
THE FAIREY AVIATION COMPANY LIMITED · HAYES · MIDDLESEX

D. H. 110

(TWO ROLLS-ROYCE AVONS)

The de Havilland 110 two-seat day-and-night jet fighter carries comprehensive "all-weather" radio and radar aids and has a performance comparable with any fighter of the new generation

DE HAVILLAND



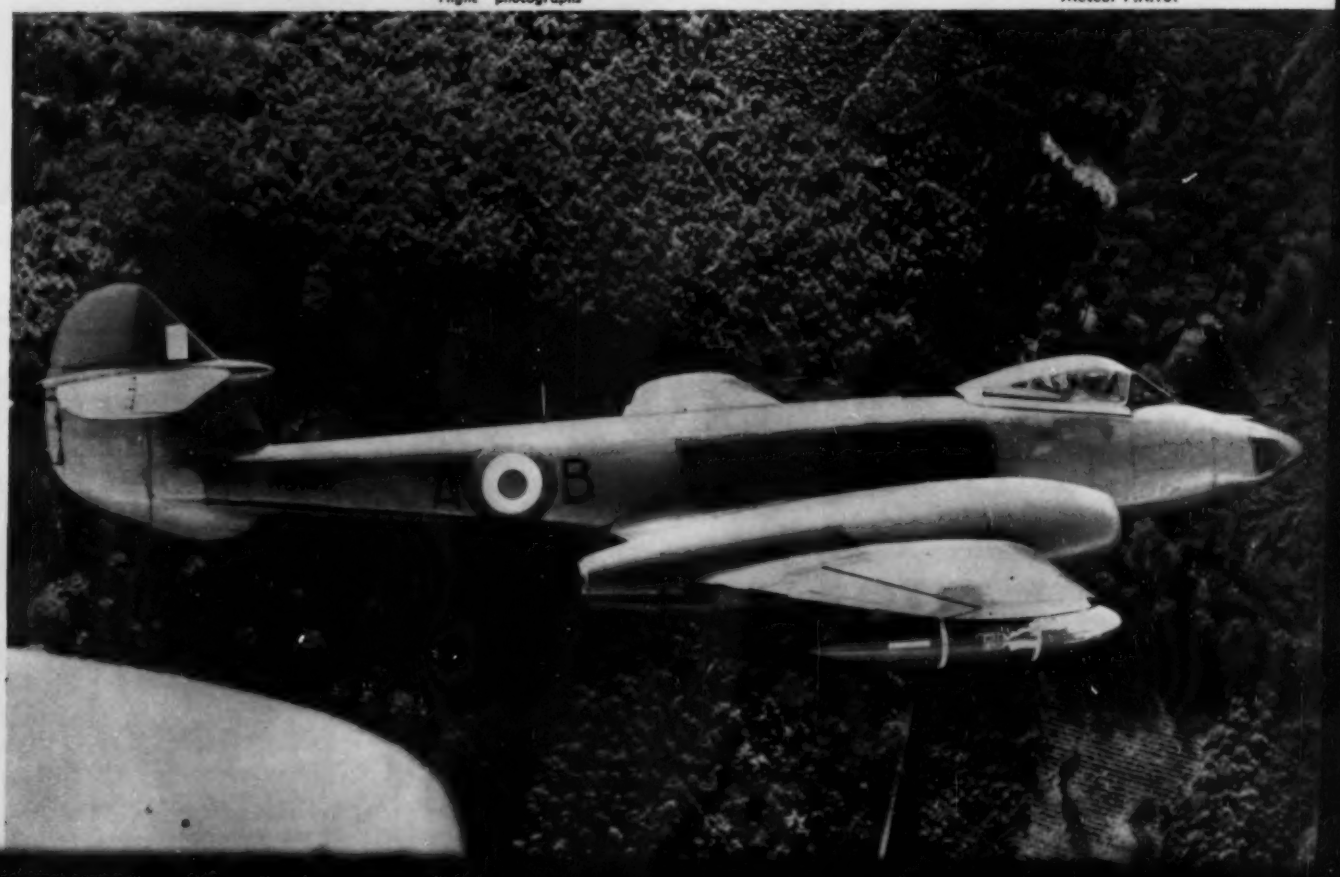
Meteor F.R.9.

BATTLE ROYAL

PART TWO

IT may be remembered, from Part 1 of this account, last week, that Air Marshal Broadhurst had referred to new ground equipment which, he hoped, would improve the speed and quality of photographic processing and interpretation. He had in mind particularly the new Mobile Photographic Section, which was operating during Battle Royal in the Gutersloh area. Camouflaged and self-supporting, this unit was capable of turning out reconnaissance pictures on a scale never before equalled in any Service. Its development, we were told, had

"Flight" photographs



Meteor P.R.10.

"FLIGHT" photographs

Three types of reconnaissance aircraft which operated from Gutersloh: in the lead, a F-84G Thunderjet, with a Gloster Meteor F.R.9 to port and P.R.10 to starboard.

Venom F.B.1 pilots of No. 16 Squadron, which operated under field conditions from the new NATO strip at Norvenich. S/L. de Burgh, the C.O., is sixth from the right.

Another group at Norvenich, composed of pilots of No. 94 Squadron (Venom F.B.1s), with G/C. Mellor, station commander of the Wing's base at Celle, second from left, and S/L. Bower, the C.O., on the extreme left.

Capt. Goff, U.S.A.F., who commanded the four night-reconnaissance B-26s based at Gutersloh.

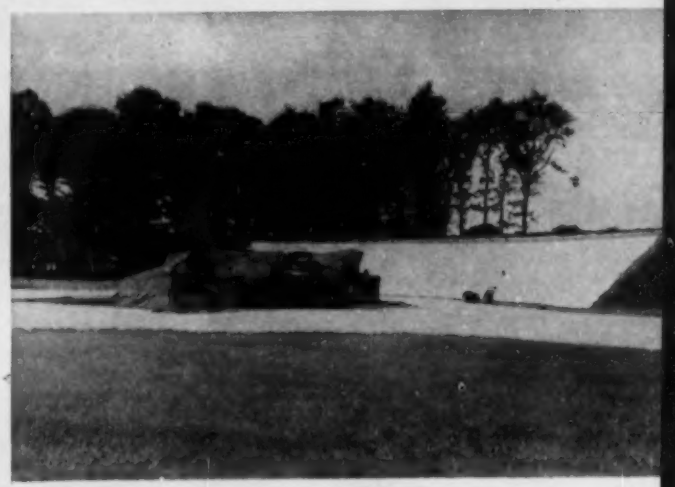
W/C. Wintle, wing commander flying, No. 139 Wing (Venom F.B.1s).

BATTLE ROYAL . . .

proceeded at such speed that virtually five years' work of planning, designing and organizing had been crammed into twelve months. The driving force was S/L. F. H. P. Lewer, who had recognized at the close of last year's Exercise Coronet that, with situations changing from hour to hour, the "huge delays" in getting results of reconnaissance to operational staffs rendered the work almost useless. The new section was having its first real try-out in Battle Royal. Immediately a reconnaissance aircraft landed from a sortie, the film magazine was rushed to a Mobile Field Photographic Section on the airfield. This was the beginning of "Phase 1" of the photographic procedure—a phase involving immediate developing, and the production of a minimum number of prints for "plotting" and for the preparation of immediate intelligence reports. (Plotting involves the numbering of map sections coinciding with the pictures.) While the processes were going forward pilots were in the operations room tracing their "runs," and information which was forthcoming was then forwarded to the Army and the R.A.F. photographic interpretation division, where the prints were scrutinized immediately they became available. Until recently, one gathered, the time taken for pictures to reach the interpreter was sometimes as much as 36 or 40 hours, whereas today they are being produced in under six hours. In the case of Tac.R. films, the aim is to carry out immediate interpretation within 35 minutes of the landing of the aircraft, and most of this may be achieved by direct viewing of the negatives. The entire processing work is done in a mobile unit of some 40 vehicles, attached to the Reconnaissance Wing.

On completion of the interpretation and plotting "Phase 2" comes into effect. This is the mass-production stage, involving the new equipment, of which Air Marshal Broadhurst had spoken, and which can raise print-output to an unprecedented figure. The unit responsible is about twice the size of that involved in Phase 1, and although

The "clutch" of operational vehicles at Norvenich.



With some of his pilots at Norvenich is S/L. Johnson (centre), officer commanding No. 145 Squadron. The Venom F.B.1 is that flown by the squadron leader and bears his own insignia, the squadron badge, flight letter and squadron markings.

Above, a camouflaged Venom F.B.1 in its revetment at Norvenich, and below, a similar machine taxying in at the same strip after a sortie against Northland forces.

"Flight" photographs

Canadair-built Sabre 4s from Brüggen. These aircraft have the "slick" wing, with the "6/3" leading edge.

BATTLE ROYAL . . .

both "clutches" may be many miles apart, their work is closely dovetailed. Constant reports keep the Co-ordinated Central Progress Control Section at H.Q. 2nd A.T.A.F. informed of progress, so that the situation in respect of first- and second-phase production can be presented at any hour of the day or night.

To carry the photographic equipment, generators, water and chemicals for a seven-day operation requires an impressive number of support vehicles, many of which carry nothing but 700 gallons of water to supplement the 200 gallons stored in each of the photographic trailers. There is, additionally, pumping equipment for the utilization of local sources of water.

Two of the vehicles are diesel ten-tonners, each capable of being expanded to an overall area of 500 sq ft. The first of these houses the "mosaicing" tables (on which the mosaic and target maps are made) and the enlargers for scaling prints. The mosaics are re-photographed and distributed to Army and Air Force intelligence and operational staffs. The second ten-tonner contains an 80 × 80 cm copying/enlarging camera, and it is believed that the

Left, one of the Brüggen Sabres breaks off. Above, with G/C. Crawford-Compton the base commander (centre) are some of the Brüggen Sabre pilots.

PIONEER DESIGNERS OF THE EJECTION SEAT

News Flash

LOW EJECTION AT CHALGROVE

To determine a minimum altitude at which a safe ejection is practicable, with their latest Fully Automatic Ejection Seat, the Martin-Baker Aircraft Company conducted air tests at Chalgrove Airfield, Oxfordshire, on August 29th, 1954.

During the tests an ejection was made from a Meteor aircraft flying at 512 m.p.h. at the remarkably low height of fifty feet. The ejection was completely successful, the main parachute being fully deployed before the dummy alighted without injury.

This astonishing feat was made possible by the employment of two stabilising drogues in tandem, designed to reduce, with acceptable deceleration, the speed of the seat after ejection and then to control the main deployment of the parachute, thus eliminating the explosive opening characteristic. This seat was also fitted with the Martin-Baker Patent Barometrically Controlled Time Release Mechanism and Drogue Gun.

With this arrangement automatic separation from the seat after ejection occurs with insignificant loss of height, and safe escapes near the ground are made practicable. No other ejection seat is capable of this performance.

These design features are patented in the principal countries of the world.

MARTIN-BAKER

AIRCRAFT COMPANY LIMITED HIGHER DENHAM NEAR UXBRIDGE MIDDLESEX

The flying-boat

RESURGENT TRANSPORT AIRCRAFT

WHILST *the post-war recession of the flying-boat was naturally a great disappointment to those who devoted their lives to the design, construction, flying and operation of this type of aircraft, it in no way dismayed them. They were certain that the flying-boat would return as an important factor in air transport.*

Even the delay in giving the great Saunders-Roe Princesses *an opportunity to demonstrate the commercial merits of the large modern flying-boat was to them no more than an unfortunate setback. Now they can see that their faith is to be justified.*

How it happened

The reasons for the flying-boat's temporary setback in air transport are easy to understand. First, as a result of the war, the runway aerodromes, built under wartime financial conditions, were ready for use in most parts of the world—and few realised that the prohibitive cost of *new* runway construction would soon begin to restrict the size (and efficiency) of landplanes.

LATEST OF THE LINE

The 140-ton Saunders-Roe Princess, *heralding the flying-boat's come-back in world air transport.*

Secondly, it was erroneously believed that large flying-boats could only operate from costly artificial bases—instead of natural stretches of water such as the Solent.

Then there was the idea that base facilities would invôlve heavy capital outlay—when in fact their cost is insignificant compared with landplane bases.

How wrong it would have been if, through these fallacious ideas, the flying-boat had remained unexploited—when it can lead to safer, faster, more economical passenger travel and military transport on the world's long-stage routes.

Princess the pointer

Marking the beginning of the resurgence of the flying-boat are the Saunders-Roe *Princesses*—each capable of carrying 130 passengers luxury-class or 220 tourist-class direct to New York. On long-range trooping operations, these three flying-boats could transport as many men as nine troopships.

And of course water-based aircraft like these can take full advantage of all the modern navigational aids and safety measures. Up-to-date docking and pontoon equipment has simplified maintenance and reduced dependence on surface craft. The large long-range flying-boat can now offer the fastest overall speed for long haul services.

The deciding issue

But what is decisive in bringing the flying-boat back into world air transport, both civil and military, is its flexibility—the fact that it can operate without pre-arranged facilities and accept re-routing at short notice. Think of the importance of this when political and military disturbances are liable to occur in almost any part of the world.

With sufficient flying-boats—modern, and large enough to offer low cost per ton-mile for all long-range operations—the prudent transport operator and military commander will be able to maintain communications over improvised or even entirely new routes.

That the flying-boat will come into its own again, that this valuable and natural heritage of the British Commonwealth will not be cast aside, is vitally important to us all.

An announcement by **SAUNDERS-ROE**

The mobile field hospital which moved 200 miles by road. In the distance is the great NATO-pattern R.A.F. airfield at Brüggen.

"Flight" photograph

BATTLE ROYAL . . .

R.A.F. is the first Service ever to put such a camera into a vehicle. A ten-ton trailer, equipped with mosaic-making and processing equipment, is drawn behind.

No less remarkable are the multiple-printing and processing units—ten-ton "semi-trailers" each capable of turning out over 500 prints an hour. Under ideal conditions, in fact, seven of these units, working over a 24-hour period (and allowing for a change of chemicals and for maintenance) could produce and despatch up to 100,000 prints. Consumption of bromide paper during Battle Royal was expected to reach 350,000ft. These great vehicles are designed to operate in all climates; they are insulated, have automatic air-and-water cooling, and a universal tractor coupling ensures that they can be pulled by any NATO vehicle. They have their own telephones, chemical storage and mixing plants, and thermostatically controlled solution tanks. Six three-ton trucks are fitted with special fire protection appliances and used as mobile film stores.

The various units are manned by W.R.A.F. and R.A.F. personnel—four to a multi-printer unit. Operator No. 1 is in charge of the machine, and receives the developed film from the Mobile Field Photographic Section—that is, from Phase 1. He sees that the bromide paper (in rolls of 800-1,000ft) is threaded through rollers which carry it to the exposure frame, and to the developing, fixing and drying sections. Then he sees to the print exposure. No. 2 keeps watch on developing, fixing and drying, and No. 3 trims the rolls of paper into separate prints. No. 4 sorts the finished prints into batches ready for despatch and keeps an eye on their quality.

Battle Royal was likewise a try-out for the Airfield Construction Branch of 2nd A.T.A.F. A relatively new formation, the A.C.B. is responsible not only for the preparation of great air bases to NATO specifications, but is charged also with keeping them in order. Moreover, in the event of their being heavily damaged, it would be the task of the Branch to construct temporary strips. Much of the work, of course, is of a more or less static nature, but the Branch maintains "flying columns" of bulldozers at strategic points.

In Battle Royal squadrons of the A.C.B. were alerted and sent off on long journeys through the country areas. One of them hauled more than 500 tons of bulldozers, rooters, earth-scraping equipment, concrete mixers and track-layers—and progress all the way was impeded by simulated battle conditions. One unit had come from helping to build one of the biggest NATO bases in the Rhineland in the record time of eleven months; another had just finished laying five million square feet of concrete runways in eight weeks. As it was put to us, "nothing is done in a small way by the A.C.B. if there is a big way of doing it"; thus, concrete is mixed not by the hundredweight but by the hundred tons. When the mixing machinery is on site and the components are pieced together, an 80ft-high "factory" results, into which ten-ton lorries drive to fill up from its giant chutes and maintain their shuttle service to the construction gangs. The laying of runways, perimeter tracks and hangar floors is accomplished by the technique developed for the autobahns: mechanical levellers shunt along 20ft-gauge railway lines, smoothing out thick carpets of concrete as the lorries ceaselessly pour the mix.

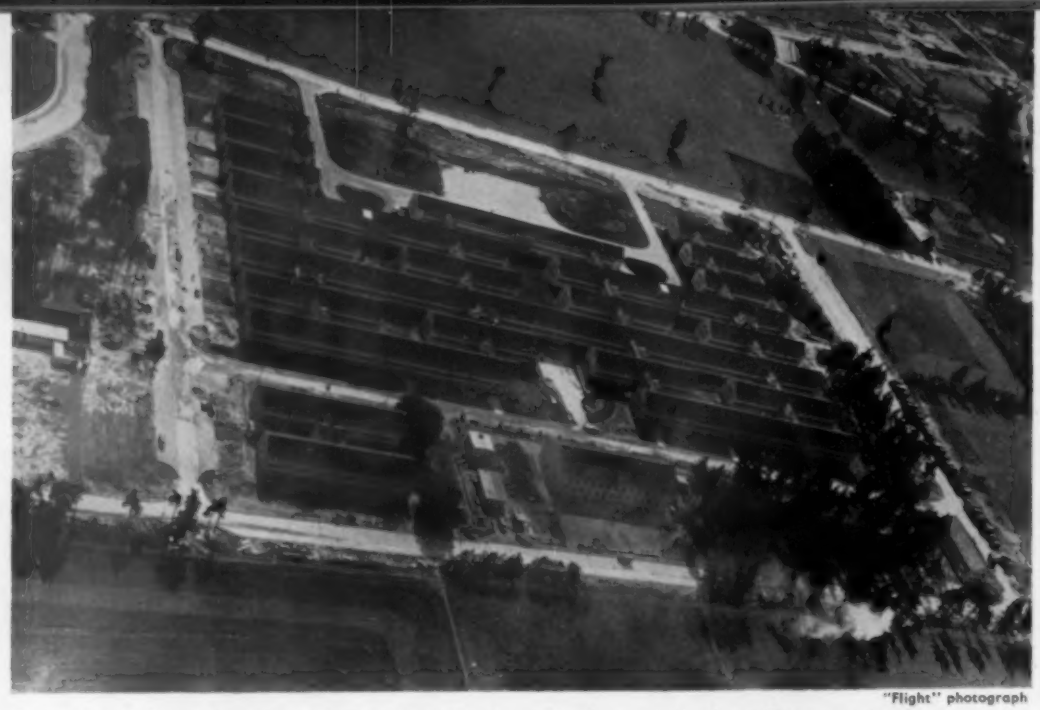
The A.C.B. is nothing if not resourceful. This summer a bridge used by its trucks to bring rock, gravel and sand into an airfield was weakened by heavy rains, and the local authorities declared it unsafe; whereupon the Branch diverted gangs for 24 hours to build a new bridge and force an alternative entry into the site.

Another unit of great importance which took the road in Battle Royal was a Mobile Field Hospital of the R.A.F. From its base at R.A.F. Hospital Rostrup, it moved, in forty three-ton vehicles, to a site at Brüggen, 200 miles away. (Ironically enough, on the shooting-in butt of Brüggen's great NATO airfield.) We ourselves looked in at the M.F.H. when it had been on site nearly 24 hours and was almost ready to receive patients. A general hospital, capable of dealing with all but the most critical of medical and surgical cases, it had a hundred beds and could, in emergency, accommodate another fifty. The exercise was a test not only of its mobility, but also afforded an opportunity for the doctors to investigate convoy accidents. It had been found that the greatest number of mishaps occurred after an exercise of this sort was over, suggesting that the cause lay in fatigue.

The convoy comprising the hospital included two water bowsers, and equipment for utilizing local sources of water. Medical supplies for three months of "normal" operation were carried, and the M.F.H. was closely linked up with a Casualty

Douglas RB-26 night-reconnaissance aircraft which operated from Gutersloh. Maximum speed approaches 360 m.p.h.

"Flight" photograph



"Flight" photograph

The new 2nd A.T.A.F. Headquarters at Munchen Gladbach, photographed from a circling Anson. This is a combined headquarters, to which the H.Q. commands of the air forces and army will move during the next few weeks.

BATTLE ROYAL . . .

Air Evacuation Section, which flew out cases and brought in supplies. Of the fourteen tents, those used for the operating theatre and the anaesthetic ward were, we found, an English modification of a type used by the German Afrika Korps. They were being used by the R.A.F. for the first time. Erected without guy ropes, they can be put up by six men in three-quarters of an hour. Each allows a layer of air to "buffer" the heat in summer and the cold in winter.

Over a hundred members of the W.R.A.F. took part in Battle Royal. Thirty—under the command of Flt/O. Rosemary Mills—were living under canvas, manning a mobile photographic unit and maintaining signals communications for the R.A.F. and the Netherlands and Belgian Air Forces. Seven W.R.A.F.s were on the staff of the Mobile Field Photographic Unit, under the command of S/L. Lewer, and twenty W.R.A.F. telephonists, telegraphists and teleprinter operators in the R.A.F. Mobile Signals Unit maintained 2nd A.T.A.F. communications throughout. Additionally, of course, there were the parachute packers, equipment assistants, medical orderlies and admin. and accounts clerks at their permanent units, and plotters at the Air Control Centre.

Although, as will have been gathered, Battle Royal had a "ground" emphasis, there was plenty to see on the flying side, and we took an early opportunity of boarding an Anson for the new NATO strip at Norvenich, to which tented site No. 139 Wing had deployed from Celle, a base in the east. The Venoms of the Wing were providing close and general support for a Belgian corps, and all the operational tents were concealed. (Normally those concerned with the domestic and administrative sides would likewise be hidden, but the condition of the ground was such that this final touch of realism was waived.) No. 139 Wing is composed of Nos. 16, 94 and 145 Squadrons, all equipped with Venom F.B.1s. Support, we were told by the Wing Commander Flying, could be of two principal kinds, namely direct support (which was the most usual, and involved attacks on troops, tanks, guns, etc., in the line), and indirect support, by which is implied the harassing of troop movements and of supplies being moved up to the line. There were, in turn, two forms of direct support, namely, pre-arranged support (which would usually be worked out the night before the operation, perhaps to cover a withdrawal), and immediate support, given in response to demands from the troops over the A.S.S.U. (Air Support Signals Unit) network. In the ground-attack rôle the states of preparedness were: "Available"—pilots available in the briefing room within 15 minutes; "Readiness"—pilots sitting in the crew-room in their flying kit; and "Standby"—aircraft on the operational readiness platform. (This last state was unusual, but would be occasioned if a strike were to be put on to a pre-arranged target in co-operation with an Air Control Team in the field).

The runway at Norvenich is 8,000ft long and is literally cut in a forest of trees which crowd to within a few feet of the edge. This being so, the Venoms were prudently taking off at 10-sec intervals, though from their base they depart in close pairs.

No. 94 Squadron (the MacRobert Squadron) had just completed a strike up to Bielefeld on a supposed concentration of vehicles, which had, in fact, dispersed. S/L. Bower, the C.O., drew our attention to the squadron flag (his wife's handiwork) with the mystic cyphers 94/51 embroidered in a corner. It seems that 51 was the number of an R.A.F. Regiment squadron which, having been the first to "capture" the flag, considered itself entitled to figure thereupon.

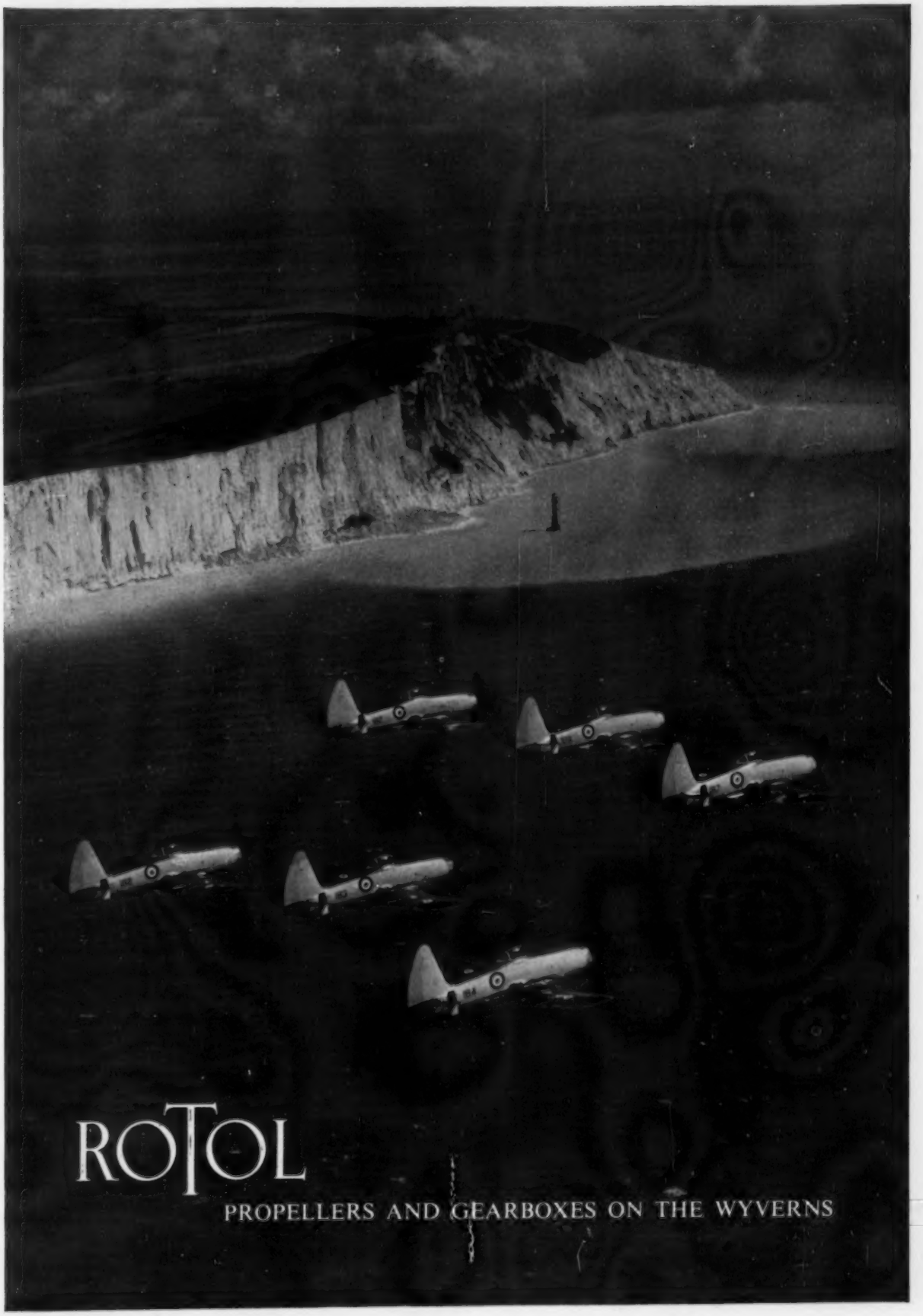
Crossing over to No. 16 Squadron, and stalking a Venom through the trees, photographer McLaren was enjoined to keep off the grass, wherein an unexploded German mortar shell had been detected. No. 16 is the oldest of the three squadrons comprising 139 Wing, and should soon be getting its Standard. Flying with the unit when we called was S/L. John Phipps, of the Day Fighter Leaders' School, West Raynham, who, on the previous day, had been operating as a Northland pilot from Wunstorf. S/L. de Burgh told us that some of his squadron's aircraft had just been in action against Centurion tanks and troops in the Herford/Bielefeld area. (As for morale of the Venom fighter/bomber pilots of 2nd A.T.A.F., we need only record that the pilots of "16" were much distressed that we should have called on "94" before themselves—until one of their number came forward with the consoling supposition that the picture of their rivals would be appearing in *Junior Flight*.)

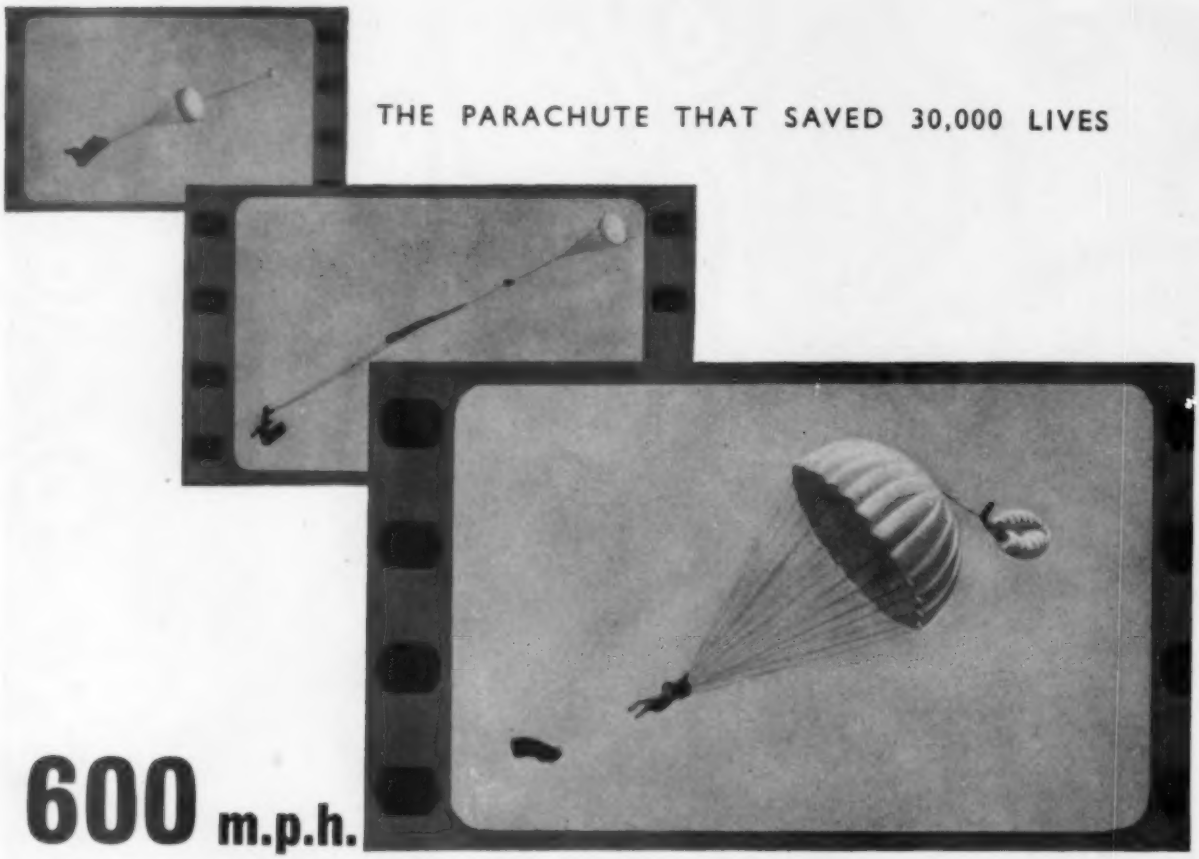
On our way to No. 145 Squadron we noticed that the homer was the only item of operational equipment which might be visible from the air. Its power supply was concealed in the woods behind. No. 145 (S/L. Johnson) had been in action that morning against Centurion tanks and soft-skinned vehicles. We questioned the squadron leader on the performance of the Venom *vis-à-vis* the Sabre, and he assured us that he and his pilots, having tangled many times with the F-86s, were getting quite a superiority complex. In manœuvring, he said, the Venom had it all over the Sabre "like a tent." Rate of climb was superior, and, if a Sabre broke, a Venom could "follow straight through" without trouble.

From Norvenich, Faithful Annie carried us to the great NATO-type R.A.F. Station at Brüggen, from the perimeter of which one can look into Holland. The base is commanded by G/C. W. V. Crawford-Compton, D.S.O., D.F.C., who explained that he had insisted on keeping more trees than usual on a NATO base to serve as camouflage. The station farm, with its wheat and potato crops, blended with the airfield, and helped to break up tell-tale hard lines. Brüggen's main runway is east-west; length is 2,700 yd and width 150ft. A second runway is of the same length and 75ft wide, and in emergency aircraft can land and take off from the taxi-track. We saw blast pens being put round the four great dispersals, and were reminded that these could not be wholly effective against air bursts. There are four huge fuel dumps, which will eventually be replenished by pipeline.

About 300 families live in the married quarters of the station, and among the amenities are a large NAAFI shop, a cinema seating 350, eight tennis courts, the same number of football pitches, a swimming pool and a riding club. The gliding club won the 2nd T.A.F. championship last year.

G/C. Crawford-Compton explained that it is a disadvantage for present-day fighters to be up near the front line, for, on the climb, their forward speed is so great that at one time they must


ROTOL
PROPELLERS AND GEARBOXES ON THE WYVERNS



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BATTLE ROYAL . . .

turn their backs on the enemy. From Brüggen, on the other hand, it was possible to do a straight climb. Moreover, the Army were not embarrassed by having to look after the squadrons in the front areas.

In war-time the buildings on the station would be abandoned and personnel would go "into the country." Already as many as five squadrons have been operated from Brüggen, and on several days 530-540 take-offs, and a similar number of landings, have been logged. Both runways can be used together—one for take-off, one for landing.

Squadrons at home when we called were No. 112 (commanded by S/L. Hegerty, who treated us to a flashing Sabre demonstration), and No. 130 (S/L. Megor). The Sabres had been stood-down from Battle Royal for the day, but four aircraft of "112" had gone over to Wildenrath to beat up the ack-ack and test the reporting system.

Back at our own base at Sennelager we learned that on the night of September 23rd 85 Canberras had set out to test the defences of 2nd A.T.A.F.; but weather was such that only 27 got through. There were seven interceptions.

The expected "paradrop" by the Territorials from C-119s of the U.S.A.F. had to be called off; but that Battle Royal had been a very profitable exercise for 2nd A.T.A.F. was declared by A. V-M. J. H. Edwardes-Jones, who deputized for the C-in-C. at the final briefing. On the same occasion Gen. Gale made the point that, for the first time in any exercise, a tactical air force had had the opportunity of taking part with a full complement of troops "actually on the ground, and there to be found."

A. V-M. Edwardes-Jones said that the exercise had shown the importance of land/air co-operation at group level instead of (as in so many past exercises) at corps level. "At group level," he said, "you get the necessary long-range and long-term view which it is not the business of corps commanders to consider, although it has necessarily to be the business of air forces." The air forces had been very successful in finding the atomic guns and putting them out of action, though, being speedy and well camouflaged, these were considered by the Americans to be difficult to locate. In reconnaissance it had often happened that the weather had put squadrons out of action. This problem would have to be looked at "a great deal more" to see what could be done to deal with it, but eventually it should be overcome.

A Designer on Tomorrow's Bombers

As we recorded last week, the eleventh quadrennial Gustave Canet Memorial Lecture was read before the Junior Institution of Engineers on September 24th by Mr. David Keith-Lucas, B.A., M.I.Mech.E., F.R.Ae.S., the vice-president of the Institution. Mr. Keith-Lucas, who is a director and the chief designer of Short Bros. and Harland, Ltd., chose for this occasion the subject of bomber design, and he began by outlining the history of the bomber as a weapon of war and went on to discuss the effect on design of such functions as vulnerability, defensive armament, operating altitude and manœuvrability.

Particularly with regard to the last heading, the lecturer drew a comparison between, on the one hand, the British type of four-jet medium bomber with its large wing and (he expected) good manœuvrability and, on the other, the American Boeing bombers, which had a considerably higher wing loading and seemed to be rather less pleasant to fly. Nevertheless, one could not conclude that the American aircraft were necessarily worse bombers than the British, especially for the very long ranges over which they might have to operate. Manœuvrability might be of little use against guided missiles; even were it possible to devise radar apparatus capable of giving sufficient warning of the approach of a guided weapon one would still need a very manœuvrable aircraft to get out of the way in time.

One had therefore to consider other ways of escaping the attentions of guided weapons. These included the possibility of going so fast that the enemy had little chance of getting his missiles into the air or so low that the missiles could not pick up their target because of ground interference. The latter suggestion posed "horrible" design problems. Flying at high speed over enemy territory at a height of a few hundred feet would be extremely bumpy and would require a great deal of ingenuity in order to obtain sufficient range and accurate navigation.

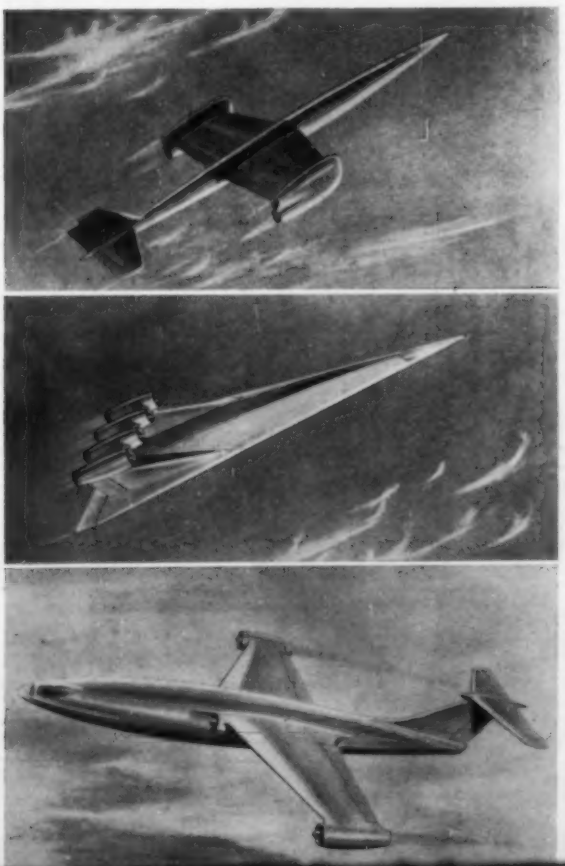
The range was directly proportional to the lift/drag ratio. This could be re-written as lift coefficient divided by drag coefficient and, in order to maintain the highest possible value of lift coefficient at the selected altitude, the speed had to be high, which could be achieved only by making the wing loading also high. To get a really useful load, wing loadings of 200 or even 300 lb/sq ft might be necessary. This would have advantages from the point of view of comfort in rough air but would severely restrict stowage space, particularly for fuel.

The real problem of such wing loadings would be that of take-off; various solutions existed, including the composite aircraft with extra wing area for take-off, and the water-based aircraft which could probably accept take-off conditions too severe for rubber tyres. The lowest of the three illustrations gives a rough idea of what Mr. Keith-Lucas had in mind; "But," he said, "I leave you to guess how it got into the air."

The alternative approach of flying as fast as possible at a relatively high altitude gave rise to many of the same problems. Range was unlikely to be a great problem, by virtue of the speed involved, in spite of the fact that supersonic lift/drag ratios were low. The so-called heat barrier, however, was likely to prove "not very easy to dodge." Not only the basic structural materials but the crew, fuel, hydraulic fluid, electronic equipment and electric generation machinery all had to be kept cool, and this might be difficult with air at 200 deg C.

There appeared to be two optimum forms for a supersonic bomber of this type. The wings might either be straight or swept back at about 80 deg in the form of a very narrow delta. In the former case the thickness/chord ratio could not be more than about 4 per cent and the wings would therefore be of little use as stowage space. In neither case would the wing be much good at slow speeds. The designer was therefore faced once again with the problem of finding a means of getting his bomber into the air and back again on to the earth.

These problems made the idea of the pilotless expendable bomber very attractive. If one analysed the reasons for carrying a crew the important factors would probably be navigation to, and identification of, the target. If no crew were on board the return flight would not be necessary, and Mr. Keith-Lucas considered that from the economic viewpoint the pilotless expendable bomber might be no more expensive than the conventional machine when everything was taken into account. The only possible weak points of the pilotless bomber were its navigational accuracy and penetrating power (ability to reach the target).



Three possible forms of bomber: from the top, a straight-winged supersonic bomber, another supersonic bomber with a wing swept to an angle of about 80 deg (note, this aircraft has four turbojets mounted above the trailing edge of the wing) and a low-altitude bomber with a very high wing loading.

CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns; the names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

Vertical Take-off—1906

ONCE more the old adage "there is nothing new under the sun" crops up. This idea of vertical jet propulsion in lieu of helicopter lift is yet another case of something "new" being older than the aircraft industry itself.

The year 1906 (the year of Santos-Dumont's 100-yard flight at Issy-le-Molineux, Paris) saw the birth of the aircraft movement in Britain. The daily newspaper, which, in that year, offered a prize of £10,000 for the first aeroplane flight from London to Manchester also sponsored a small aero exhibition in London, about the same time. Naturally, the show was all models; no exhibitor had anything full-size to produce.

The writer (then a young draughtsman of 22) visited this show, and observed, among the exhibits, a contrivance shaped like a drum, about 18in diameter and standing on four cone-shaped hollow legs. Upon enquiry of the inventor as to what the device comprised, the writer was informed that jet reaction from the four legs lifted the apparatus into the air, and sustained it there.

The inventor had made no provision for horizontal propulsion when (if ever) he got his device into the air. Naturally, he was vague and mysterious regarding his means for developing his jets, which left the writer of opinion that the drum was designed to contain nothing more abstruse than ordinary rocket compound. However, the germ of the idea was there, notwithstanding the means employed to produce jet reaction.

London, S.W.17. E. V. HAMMOND.

Night Interception—1916

I HAVE been much interested in the correspondence re the B.E. 2C. I was posted to No. 39 Home Defence Squadron in February 1916, then in formation at Hounslow. A number of machines were tried out for night flying, but the B.E. 2C was finally decided on. The squadron H.Q. was moved to Woodford Green, with detached flights of six machines each at Hainault Farm, Goodmayes; North Weald Bassett; and Sutton's Farm, Hornchurch.

After experimenting with bombs and Le Prieur rockets, it was decided to mount a Lewis gun on the top plane. To this was fitted the Hutton gun-sight, the idea first coming from myself, having as a boy on a farm used a luminous bead sight on a muzzle-loading shotgun for shooting rabbits.

Cpl. Lock, in charge of the workshop lorry at H.Q., improved on this by arranging two dots of luminous paint on the backsight and one on the foresight. It worked. Sergeant Major Hutton improved on this again by having two flashlamp bulbs showing pinpoints of light through tubular back and foresights.

The tray of the gun was loaded with a tracer bullet, and then a Brock and a Pomeroy explosive bullet, repeated in that order.

I think it was September 6th that action was ordered at about 10 p.m. Early in the week I had been to Milton in Berkshire, for stores, including new upper and lower planes, which I took to Sutton's Farm. The flight commander's machine was rigged with these the next day. On the Saturday the report went to Adastral House (which was the De Keysers Hotel on the Embankment, near Blackfriars Bridge) that eighteen machines were serviceable —if I remember rightly, 12 B.E. 2Cs and six B.E.12s; the latter was a similar machine but fitted with a 12-cylinder engine interchangeable with the 90 Royal Aircraft Factory engine as fitted to the B.E. 2C.

Lt. Leefe Robinson, attached to the R.F.C. from the Worcesters, picked up a Schütte-Lanz airship over Croydon and followed it over London to the neighbourhood of Enfield, when it was picked up by searchlights. Lt. Robinson fired a red Very light, and the searchlights were shut off. We could see all this from Woodford. The next thing we saw, after a minute or so, was the airship descending in flames. Lt. Robinson made for North Weald but overshot the landing area; he went on to Hainault Farm, where the same thing happened, so he eventually made for Hornchurch, where he landed almost out of petrol.

Attleborough, Norfolk. L. A. POSTLE.

[Our correspondent, at nearly 71 years of age, still maintains a keen interest in aeronautical affairs. After leaving the R.A.F. he worked on the R.33 airship, and subsequently for C. C. Wakefield and Co. In 1938 he was the twelfth recruit for barrage balloons, but was demobilized at the outbreak of war as being too old; he then became an instructor, until 1945, at a military school of motor maintenance.—ED.]

Navigational Aids

THE author of the article "Ground Radar and Radio," in your issue of September 24th, appears to labour under a few curious misapprehensions in so far as Decca is concerned.

In discussing the use of Decca for helicopters he says "it is at present problematical whether administrations could afford to provide this system exclusively for helicopter operation."

We have always contended that the navigational aid finally adopted must meet the requirements of as many types of user as possible, e.g., fixed-wing aircraft, helicopters and shipping, since it is only by so doing that the cost of providing the required navigational facilities will not be prohibitive.

Until some few months ago we seemed to be a lone voice crying in the wilderness on this subject. Now, however, we are joined by the Air Navigational Development Board of the U.S.A., which has recently issued a specification for a new short/medium-distance common-user aid to serve both fixed-wing aircraft and helicopters. This specification, incidentally, effectively precludes any V.H.F. system since, amongst other factors, it postulates coverage from 60,000ft to the ground and out to 200 miles.

We will refrain from comment on your contributor's statement "Why have international standards if we don't abide by them?" But we would ask you to believe that this simple question, in its application to the present short/medium-distance standard aid, is one we could answer at some length.

Finally, might we say a word on his, to us, rather naïve remark to the effect that "In the case of V.O.R. the situation is fairly satisfactory . . ." Is it? V.O.R. was made a standard some four years ago. Today fourteen are in operation in Europe and eight of those are in one country. Bearing in mind the fact that, on one carefully studied and authoritative estimate, it was envisaged that something of the order of 100 V.O.R.s would be required to cover European air routes, we cannot believe that current implementation could be regarded as fairly satisfactory from any standpoint—save, perhaps, our own.

London, S.W.9. E. R. BONNER,
Decca Navigator Co., Ltd.

IN BRIEF

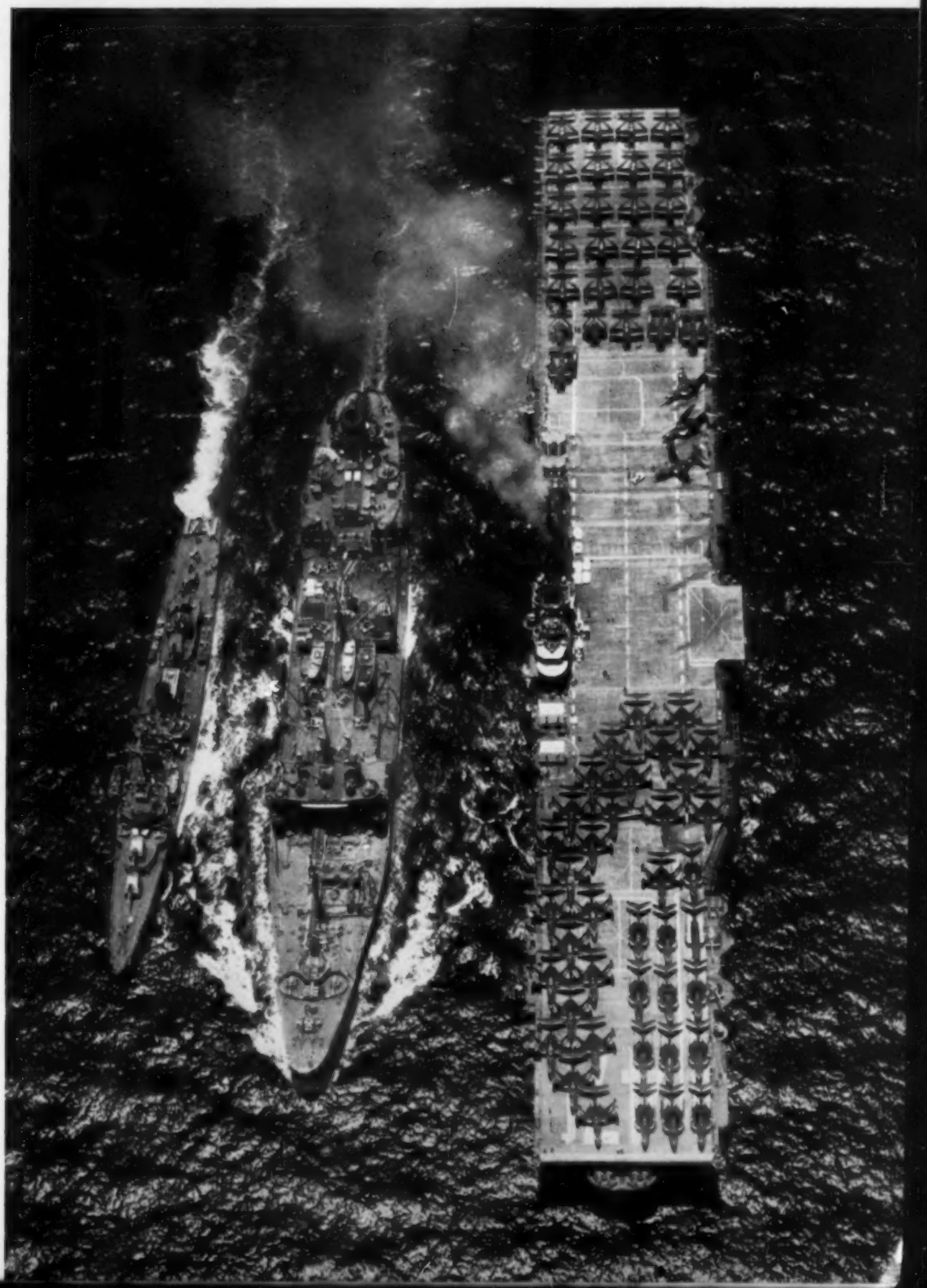
From G/C. G. W. Williamson, O.B.E., M.C., M.Inst.C.E., M.I.Mech.E., M.I.Prod.E., M.I.E.E., F.R.Ae.S., technical adviser to Short Bros. and Harland, Ltd., comes a letter on the subject of retired engineers, business executives and officers. It explains that "a few chartered engineers of good standing" have formed an organization known as the Association of Retired Industrial Executives, with the objects of, *inter alia*, (a) securing the part-time employment of retired executives, (b) arranging for the supply of pre-digested information for industry and (c) the encouragement, by means of a Guild of Inventors, of "collective creativeness . . . in youngsters with character, high intelligence, good education. . . . ." Details are obtainable (stamped envelope requested) from G/C. Williamson's London office at 139 Strand, W.C.2.

FORTHCOMING EVENTS

Oct. 11. Institute of Transport: Presidential address by Sir Gilmour Jenkins, K.C.B., K.B.E., M.C., M.Inst. T.
Oct. 12. R.Ae.S. Section Lecture: "Behaviour of Light Alloys at Elevated Temperatures," by B. C. Gadd.
Oct. 13. Radar Association: "The Decca Navigator," by G/C. E. Fennessey, O.B.E., and H. G. Hawker.
Oct. 13. Rochester Flying Club: Annual dinner and dance, Bearsted.
Oct. 15. Helicopter Association: "Application of Gas Turbines to Helicopter Propulsion," by J. Brown.
Oct. 15. The Airlines Ball, Royal Albert Hall, London, 8 p.m.-2 a.m.
Oct. 19. R.Ae.S. Graduates' and Students' Section: "The Propeller-Turbine in Airline Service," by T. M. Corson.
Oct. 21. R.Ae.S. Main Lecture: "The Development of Reheat," by J. L. Edwards.
Oct. 25. University of Liverpool Engineering Society: Survey of Helicopters, by S/L. A. Armitage.
Oct. 26. Institute of Transport: Visual aids meeting: films on air transport.
Oct. 27. Institute of Welding: Annual dinner.
Oct. 27. British Institution of Radio Engineers: Annual general meeting, and presidential address by Rear Admiral Sir Philip Clarke, K.B.E., C.B., D.S.O.
Oct.28-29. Institute of Welding: Presidential address by Mr. R. G. Braithwaite, M.I.C.E., and discussions on papers dealing with welding and materials.
Oct. 29. R.Ae.S. Graduates' and Students' Section: Reception and Dance.

Fuel for a Floating Airfield

THIS fine U.S. Navy photograph illustrates a routine refuelling operation in Far Eastern waters—an operation which, nevertheless, requires perfect station-keeping and is particularly difficult when under way in bad weather. The fleet oiler in the centre is the U.S.S. *Chemung*, of 7,256 tons; on the left of the photograph is the destroyer *Erben*, a unit of the prolific *Fletcher* class of rather more than 2,000 tons; the big carrier is the *Philippine Sea* (CVA 47) of 27,100 tons, now a unit of the American fleet guarding the troubled areas of the West Pacific. Ranged on her deck—not yet of the angled variety—are 26 McDonnell F2H Banshee all-weather fighter or photo-reconnaissance aircraft (forward on the starboard side), 15 Grumman F9F-6 Cougar fighters (forward port and two further aft), a lone Panther (with two Cougars aft), three Grumman Avengers, two Chance Vought Corsairs and 21 Douglas Skyraiders (all aft). The hoses—seen suspended from derricks on *Chemung's* decks—are sent across after initial contact by lines.



WORLD CHAMPIONSHIP SAILPLANE

Design and Performance of the Breguet 901

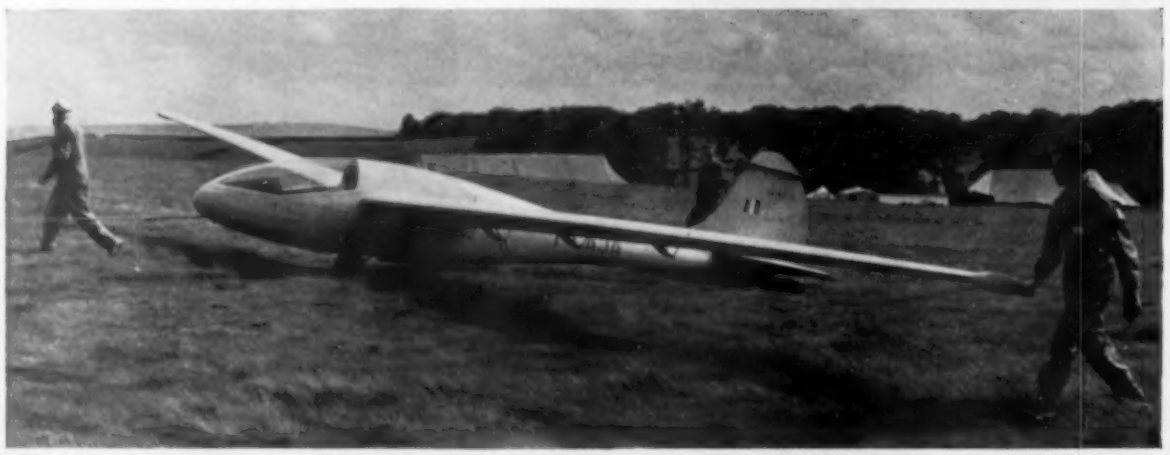
UNDER the appalling weather conditions of this year's International Gliding Championships at Camphill, it was pilot skill rather than refinement in design which counted most towards high performance. Nevertheless, the machines themselves deserved the interest they attracted. Many were already well known, but we give on this page some details of the Breguet 901, holder of several French records and in which Gerard Pierre won the single-seat championship: little information on the machine has been previously available in this country.

The 901 is basically a conventional design. It has a straight-taper mid-wing without gull effect, sweep or root fillets. Aspect ratio is 20 and span 56ft 10in, and the wing section is designed to maintain laminar flow as far back as the flap and aileron. Use of the flap permits slow flying (for circling in small thermals) without increased sink: at high speeds, the drag with −4 deg of flap is less than that with flaps neutral. Water-ballast tanks (166 lb) enable the pilot to choose the speed range at which the best performance may be obtained. These tanks are particularly important in view of the sailplane's low wing-loading, achieved in spite of the high aspect ratio and the laminar flow aerofoil.

Structurally, an interesting feature is the plywood-Klegecel sandwich construction of the wing leading edge, which maintains the accurate contour needed for laminar flow and, by increasing

Breguet 901

Span	56ft 10in
Wing area	161 sq ft
Gross weight (without water ballast)	694 lb
Gross weight (with water ballast)	860 lb
Wing loading (without ballast)	4.3 lb/sq ft
Wing loading (with ballast)	5.32 lb/sq ft
Wing aspect-ratio	20
Length	23ft 4in

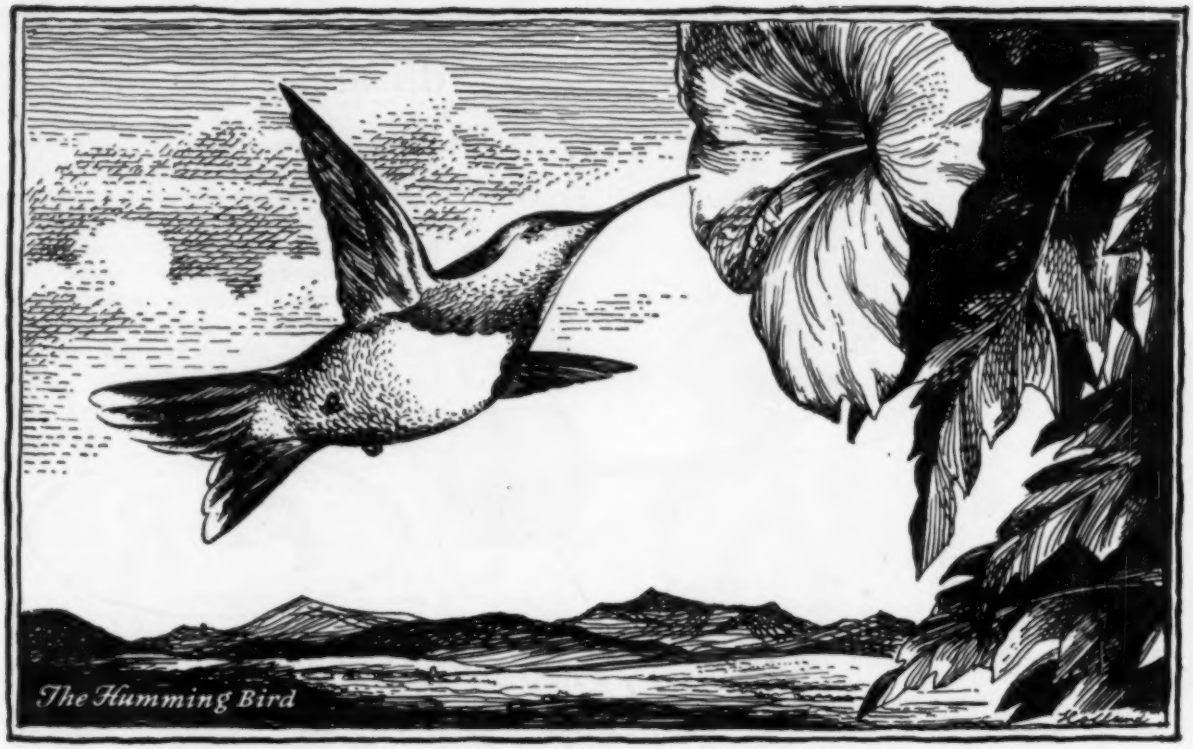


The top photograph illustrates the attachment of the flush canopy and the ease with which the instruments can be reached for maintenance. The front coaming carries a matt black upper surface.

Centre, Rousselet's 901 being taken to the launching point at Camphill. The low-drag fuselage features a semi-retractable wheel. Flap-hinges can be seen beneath the wing.

Left, one of the two 901s entered for the World Championships, seen on launch. The machine has been designed for good performance at both low and high air speeds.

Problems of flight



REFUELLING IN FLIGHT

Refuelling in flight is as old as the earliest hummingbird. Nature devised it as a special solution to special problems. Now man, faced by the same problems, has thought of it too.

The method is the same. The hummingbird's long, tubular tongue is one of Nature's developments of unusual equipment for an unusual purpose. The bird uses it by hovering over a flower, manœuvring until his beak is in position to plumb the heart of the blossom, and then syphoning up the nectar.

There is good reason for this astonishing technique. The hummingbird is tiny. (With his gaudy colouring and his wings beating invisibly fast he looks more like an insect than a bird.) Though he flies so swiftly that you can see only a blur of brilliant colour—though, unique among birds, he can fly backwards—he is vulnerable to a thousand watchful enemies. Landing could be dangerous. His mid-flight feeding is safe, quick and convenient.

In fact Nature, in the hummingbird, has met and overcome some of the same difficulties that man—who knows how many thousand years later—has met and overcome in short-range fighter aircraft.

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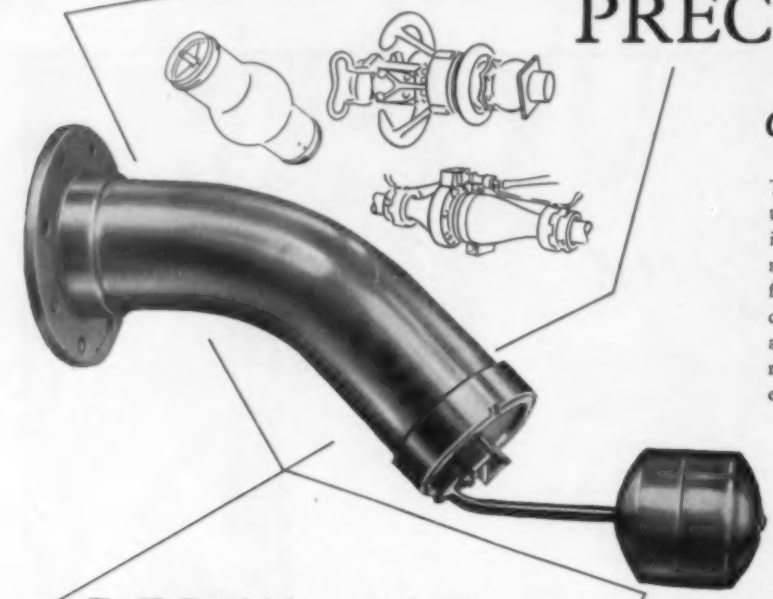

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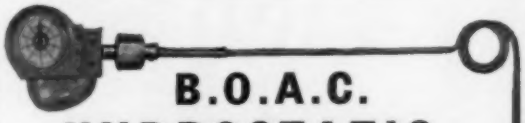

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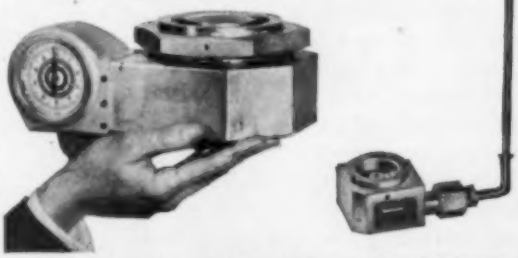

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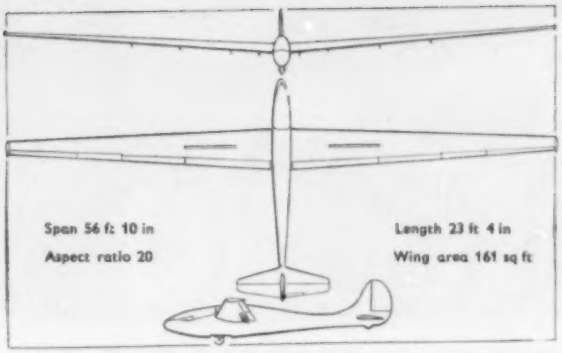
WORLD CHAMPIONSHIP SAILPLANE . . .

the torsional rigidity of the wing, improves the rolling performance. Push-rod elevator and aileron controls, dive brakes, and a retractable landing wheel fitted with a hydraulic brake, are other notable features.

From the pilot's viewpoint, the 901 is extremely comfortable to fly. The cockpit is well designed and incorporates adjustable pedals, an adjustable seat, and ventilation: radio, blind flying instruments, and oxygen equipment are also standard installations. Access for maintenance is good.

The measured flight performance of the 901 has shown a maximum lift/drag ratio of 36—an excellent figure. Without flap and with ballast tanks empty, the minimum sink is 0.6 m/sec at 45 m.p.h.; a typical high-speed performance with tanks full is a rate of sink of 1.9 m/sec at 93 m.p.h. With flaps fully extended, the minimum rate of descent is 0.65 m/sec at 37 m.p.h.

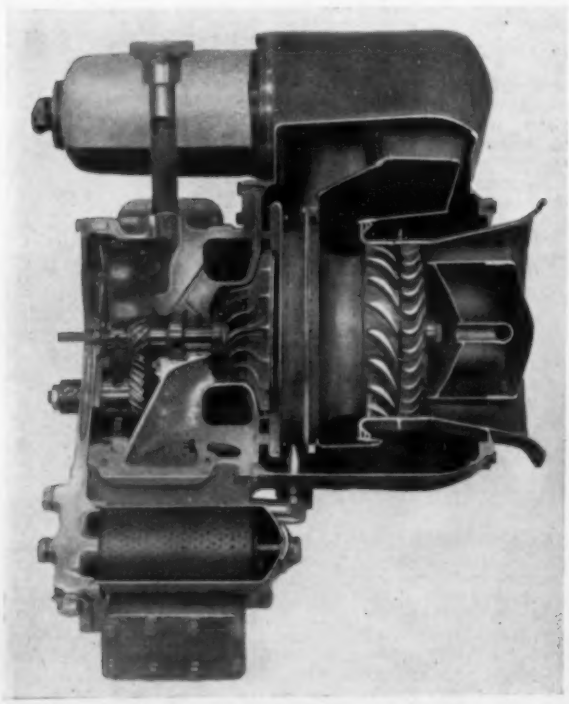


THE ROVER GAS TURBINE

VISITORS to the S.B.A.C. Exhibition noticed that accessory suppliers are turning their attention to the small self-contained gas turbine as a means of providing a flexible form of shaft power. One of the most promising of such units to have been evolved anywhere is the Rover IS/60 gas turbine, which has now been fully developed for use in all kinds of ground and airborne applications.

Broadly speaking, the advantages of the gas turbine can be listed as follows: low specific weight and bulk, fewer parts and greater reliability, less vibration, acceptance of most fuels, easy cold starting, simple installation, low oil consumption and smokeless exhaust. The disadvantages are principally: higher specific fuel consumption (except in advanced engines with high compression), sensitivity to change in air temperature and, in some cases, an inferior part-load performance. Taken all round, an extremely convincing case can be made out for the use of a gas turbine in the following typical applications: for the main propulsion of light aircraft, helicopters (with both gas drive and shaft drive) and as part of a compound unit; as an auxiliary power plant supplying compressed air or shaft power; and various airfield services such as the powering of portable fire pumps, stand-by generators, ground test units and portable packs for salvage.

One of the most obvious applications, and one which was featured on various companies' stands at Farnborough, is in the field of airborne electrical power generation. The effects of high altitude have so far precluded the use of piston-engined airborne power units, but the small gas turbine retains a larger percentage of its power at a given altitude and, furthermore, can be governed to within ±1 per cent of a rated value. It should be noted that maintenance of constant speed does not preclude operation over the full band of powers. One factor worth mentioning is that, according to the Rover Company's calculations, their gas turbine would effect a saving in fuel of 97 per cent during ground testing of electrical services compared with that required by running the main propulsion turbojets for the same purpose.



The section shows the 17-vane compressor (left), and the single-stage free-vortex turbine (right). At the top is the reverse-flow combustor.

The photographs show well the eminently practical layout of the IS/60 gas turbine. It is an exceptionally simple engine with a single-stage turbine, single-sided centrifugal compressor with a pressure ratio of 2.9:1, an air mass flow of 1.35 lb/sec and a single reverse-flow combustion chamber developed by Lucas. The lubrication system is of the wet-sump type with a pressure feed to the main bearings *via* an oil jet; high-energy ignition is fitted and the unit is started by a hand turning gear with a ratio of 100 : 1. A Plessey-Lucas fuel control unit supplies any distillate fuel to the Lucas back-spill burner. With a fuel tank capacity of 4½ Imp. gall the unit can be run for 25 minutes at full power. Other data are as given below:—

Single-shaft gas turbine, delivering 60 s.h.p. with a jet-pipe temperature of 600 deg C. Bare engine dimensions: height, 23¾in; width, 18½in; length, 19in. Weight, 116 lb. Operating speed, compressor 46,000 r.p.m. and take-off pinion 3,000 or 4,500 r.p.m. (standard) or up to 14,000 r.p.m. Fuel consumption, 1.4 lb/b.h.p./hr.

As reported in our issue of September 24th, the new apprentices' school of the Rotol and British Messier companies was opened recently by Lord Hives, Rolls-Royce chairman, who is seen (left) with Sir John Evetts, Rotol managing director, and one of the instructors. Above is part of the school's machine-shop.

THE INDUSTRY

New Survey Camera

GEOLOGICAL air survey, by the magnetometer and other methods, continues to expand in scope, and it is playing an increasingly essential part in the search for the rare earths containing the raw materials of atomic production.

In consultation with the well-known air survey company of Hunting Geophysics, Ltd., the firm of W. Vinten, Ltd. (North Circular Road, London, N.W.2), have developed a new aerial camera for magnetometer survey work. Vertically mounted, it has as its primary function the taking of a continuous series of pictures, so enabling the track of the aircraft to be accurately recorded. The camera is synchronized with a paper recorder on which the magnetometer traces are drawn. It also marks the magnetometer record, so that the two can be related after the film is processed.

The new Vinten camera and its control unit.

The illustration shows the complete camera, which is made up of the following units: the camera itself; its film cassette; the motor unit; optical counter unit; and the "intervalometer." Any unit is readily detachable.

Two essentials stated to be fulfilled by this camera are complete reliability of operation, no matter how difficult the conditions, and the ability of the operator to change the magazines very rapidly in the air; he does not have to re-thread the film through the mechanism, or even to switch off the camera. Furthermore, the camera works virtually automatically, with the minimum of attention, so that one operator can take care of both the camera and the magnetometer recorders. Brightly chequered film-drive indicators are mounted in the front of the cassette, so that the operator can see them from his seat at the control desk.

The optical counter unit, a valuable feature for magnetometer survey work, photographs a reference number (of up to four figures) on the corner of each picture for identification with the equivalent magnetometer record.

A wide-angle, short-focus lens of 28 mm is fitted, of particularly high definition.

Design-work to Order

IN an informative booklet recently issued, the firm of Aviation and Engineering Projects, Ltd., of Alexandra Road, Hounslow, Middlesex, explain something of the specialized design work which they regularly undertake for the aircraft and other industries. The layout of the four-seater Newbury Eon light aircraft, which appeared at the 1947 S.B.A.C. Show, was their first aircraft-design undertaking. Since then, other activities have included the design of major components for a number of constructors, in addition to special installations for both civil and military types. They have also carried out the redesign and strength-checking of various sailplanes and gliders. Installation design has included long-range tankage, floor modifications for freight-carrying and extra seating accommodation, dive brakes in sailplanes, special patented controllers for a tail-less glider, and catering installations in Viscounts and Ambassadors.

The company's chief technician, it is stated, was responsible for the design of the first all-metal stressed skin light aircraft to be built in this country, the C.W. Cygnet.

Among other services which A.E.P. are able to offer is the preparation and printing of handbooks, servicing manuals and similar literature, and the preparation of technical publicity.

IN BRIEF

Chamberlain Industries, Ltd., of Staffa Works, London, E.10, have recently appointed Drummond Asquith (Sales), Ltd., of King Edward House, New Street, Birmingham, 2, as sole distributors in the United Kingdom of the production tube-bending machinery which they design and manufacture in conjunction with Walter P. Hill, Inc., of Detroit, Michigan, U.S.A.

Mr. J. J. Molins, B.Sc., F.R.Ae.S., formerly chief technician at M. L. Aviation Ltd., has been appointed chief designer to Microcell, Ltd. This company, whose offices are at 56 Kingsway, London, W.C.2, are mainly engaged, with A.I.D. approval, in the development and manufacture of glass-fibre plastics; they also have A.R.B. approval for aircraft furnishings and M.o.S. approval for armament components.

From Cable Covers, Ltd., "Talurit" Division, St. Stephens House, London, S.W.1, come details of the application of the "Talurit" wire-rope splice to the Bowden wires commonly used to retain location pins in jigs and fixtures. It is stated that, with the aid of a special hand press, it takes only a few seconds to splice a wire to the pin and to form a loop at the other end for attachment by a bolt or screw.

* * *

An agreement between International Aeradio, Ltd., London, and Adalia, Ltd., Montreal, permits both companies, acting as a "consortium," to offer consultancy services to governments and to industry on a world-wide basis. The purpose is to pool specialist knowledge, experience and personnel for particular projects. First business under the new agreement is a telecommunications consultancy and planning contract with the Creole Petroleum Co., Ltd., of Venezuela. W/C. "Bill" Lawes of I.A.L. and Mr. H. T. Roberts of Adalia, with a supporting team of specialists from both companies, are now in Venezuela.

CIVIL AVIATION

Part of the loading area at Ferryfield, viewed here from the control-tower balcony. Superfreighters face the terminal for loading and unloading, and are backed out by tractors of the Douglas Equipment Tugmaster type shown on the left.

FERRYFIELD TAKES OVER

NEW chapters are constantly being added to the unique story of Silver City Airways. The latest is the news that operations from Lympne, until recently the main terminal for the company's cross-Channel ferry and the scene of its modest beginnings in 1948, came to an end at 3.30 p.m. last Sunday, October 3rd. The decision to transfer Lympne's remaining functions to Ferryfield was not unexpected; that it should be made so soon is, however, a tribute to the success of the new private airport, which was built in six months and has been in operation for only 11 weeks.

Among those who witnessed the final departure from Lympne was Mr. Sam Norman, the owner of the first car to be carried. The last of 33,487 ferry flights to and from Lympne was made, appropriately enough, by Freighter G-AGVC—the aircraft which inaugurated the service on July 14th, 1948; in command was Capt. Gerry Rosser, who was co-pilot on the original flight. Total ferry traffic subsequently handled at Lympne amounts to 54,600 cars, 18,372 motor cycles, 11,025 pedal cycles and 208,457 passengers. In return for the use of the airport and its facilities, Silver City have paid some £75,000 in landing fees to the M.T.C.A. (formerly the M.C.A.) over the past six years. This expenditure, however, was not of itself heavy enough to prompt the construction of Ferryfield, at an estimated cost of £250,000-£300,000.

Lympne required considerable development to carry the expected extra traffic, but there has never been any sign of Ministerial recognition of its recently achieved status as one of the busiest airports in Europe. The Ministry has, in fact, made a number of unsuccessful attempts to sell Lympne—the latest being in April this year, when the reserve price of £120,000 deterred would-be buyers. It will be interesting to watch the next phase in the Ministry's somewhat negative treatment of the airport. The original decision to sell it was based on the argument that it did not fit into the official pattern of U.K. airports. For this reason, the Ministry will presumably continue its efforts to sell Lympne, though its value as a producer of revenue has been greatly reduced by Silver City's initiative in building Ferryfield.

It is unlikely that the airline, having taken the plunge, has any regrets about the circumstances which led to the Ferryfield project. The efficiency of the new terminal—the first, incidentally, designed to handle vehicles as well as passengers—is already evident; furthermore, the ferry is essentially an independent organization, and many advantages are gained from independence on the ground as well as in the air. It would be difficult to estimate the period which must elapse before the project shows a clear return on the original investment: Ferryfield must logically be regarded as part of a transport system and not as an airport making or losing money on its own account.

Ferryfield was described and illustrated in *Flight* of July 2nd, shortly before it was put to work. It is now possible to bring the story up to date with some recent observations of activities there. First impressions belie the fact that this is the busiest freight airport in the country. In appearance, Ferryfield is probably the simplest modern airport yet built, consisting basically of little more than a pair of runways and a low, rectangular terminal building only 300ft long by 100ft deep.

Facing the terminal is a loading apron with space for six Superfreighters parked tip-to-tip. By running his port wheel along a line on the apron, a pilot can taxy his aircraft into one of six predetermined loading stations. Nose doors are opened as the brakes are applied and the car ramp is moved forward to the sill of the aircraft's freight hold. Scheduled time for a complete turn-round is 20 min.

Specially designed Douglas Tugmaster tractors tow the aircraft tail-first from its bay after loading and turn it through 90 deg ready for engine-starting and taxying to the take-off point. The original intention was to tow the aircraft all the way to the take-off point with the loaders remaining in the hold to complete the shackling-down of cars. A new method of shackling, however, has halved the time previously required for this operation, which is now completed before the aircraft leaves its

(Left) This interior view of a Superfreighter's hold gives an excellent idea of the capacity of the Mk 32 version of the Bristol 170, which was specially developed for the air ferry. (Right) Ferryfield's attractive 100 yd-long terminal building contains all passenger and Customs facilities at ground level, and has a small raised section containing company offices and—shown here—control room.

"Flight" photographs

CIVIL AVIATION . . .

loading bay. Cars are held firm in flight by a chain which forms a loop round the top half of each wheel; the chain, in turn, is attached to a toggle device which picks up on attachment points in the hold and enables the chain to be tightened in a single movement of a lever.

Near the head of each runway is a holding bay where the departing aircraft can, if required, wait until an approaching machine has landed. After clearance, the outbound aircraft takes off and makes a left-hand turn on to track for Le Touquet (with Silver City's vacation of Lympne, the Calais and Ostend services also are now operated from Ferryfield). Cruising at 1,000ft, the Superfreighter reaches Le Touquet in just under 20 min, letting-down on track. The only further contact with Ferryfield is a check call at mid-Channel.

Inbound aircraft cruise at 2,000ft, and are brought in for straight-in approaches at minimum intervals of 5 miles. The Ferryfield weather minima of 1,000 yd visibility and 300ft cloud-base can be achieved without use of the Decca 424 radar installed there, as Silver City's crews have unusually intimate knowledge of the route and the descent is made over sea. The main function of the radar is to maintain the short interval between aircraft in bad weather: inbound aircraft, for example, can safely be talked down through the 1,000ft "outbound" lane, since the radar scope provides clear and positive identification. Radar guidance is also useful to pilots when visibility from the Bristol 170 cockpit is restricted by heavy rain. The proposed installation of Decca radar at Le Touquet will provide almost complete coverage of the 42-mile route. The shortness of the route makes "stacking" practically unknown: when weather deteriorates below the minima aircraft are held on the ground.

As a general rule, each Superfreighter operating between Ferryfield and Le Touquet refuels after every second round trip. A blue flag flown from the cockpit when an aircraft taxies in indicates that refuelling is required. Reserves consist of fuel for one hour's holding and for diversion to an alternative airfield.

Flying staff, headed by Capt. L. A. Madelaine, consists of 48 pilots, of whom 42 are based at Ferryfield and six at Southampton. The 24 captains have an average flying experience of 6,000 hr, and the record for channel crossings is held by Capt. Rosser, who has flown between England and France some 5,500 times since 1948. During the busy season pilots fly the full 100 hr monthly and make up to 12 Channel crossings daily. To some extent, the admitted monotony of flying the same short route hour after hour, day after day, is compensated by a continuity of domestic life which is denied to the majority of airline pilots.

The standard Superfreighter crew consists of a captain, first officer and car-marshal, who occupies a small tip-up seat in the nose of the aircraft. The car marshal's duties include supervision of the load during flight, enforcement of the seat-belt/no-smoking rule at take-off and landing, and sale of duty-free cigarettes to the occupants of the 15-seat cabin; in an emergency, he would also assist passengers in abandoning the aircraft. Part of Silver City's reputation is undoubtedly due to the fact that no such emergency has occurred in 47,000 crossings of the English Channel.

The Bristol 170's steadiness and reliability are very much taken for granted, and this is true also of their Hercules engines. Apart from training flights, only one single-engined landing has been made this year. Present strength of the Silver City fleet is six Mk 21 Freighters and nine Mk 32 Superfreighters.

"Flight" photograph

Mr. D. Cooper, senior air traffic control officer at Ferryfield, shows the Decca 424 radar installation, with twin scopes for area and approach control.

Silver City's area manager, responsible for operations from both Ferryfield and Lympne, is Mr. E. Manley Walker (right), shown here with the company's chief pilot, Capt. L. A. Madelaine.

INDIA BUYS HERONS

AN order for eight de Havilland Herons has been placed by the Indian Airlines Corporation. Delivery of the aircraft, which will be Series 2s equipped to carry 14 passengers, is expected to begin shortly. The order follows extensive studies of the Heron's performance by I.A.C. pilots, engineers and executives during two demonstration tours.

The makers state that India provides a severe testing ground for the merits of any aeroplane, and that the Indian airlines' conviction of the Heron's suitability for its routes is a testimony to the capabilities of the aircraft. With a fleet of 87 Dakotas, Vikings and DC-4s flying some 11,000 hours monthly, I.A.C. are among the world's biggest operators of domestic and regional services.

Outlining the duties which the Herons will be called upon to perform, de Havilland point out that I.A.C.'s territory includes the remote high-altitude airfields of Kashmir, the short, primitive and often flooded airfields of Assam and the hot, dry plains of the Deccan of Central India. In Delhi ambient temperatures at take-off are frequently as high as 115 deg F.

A SABENA DEFICIT

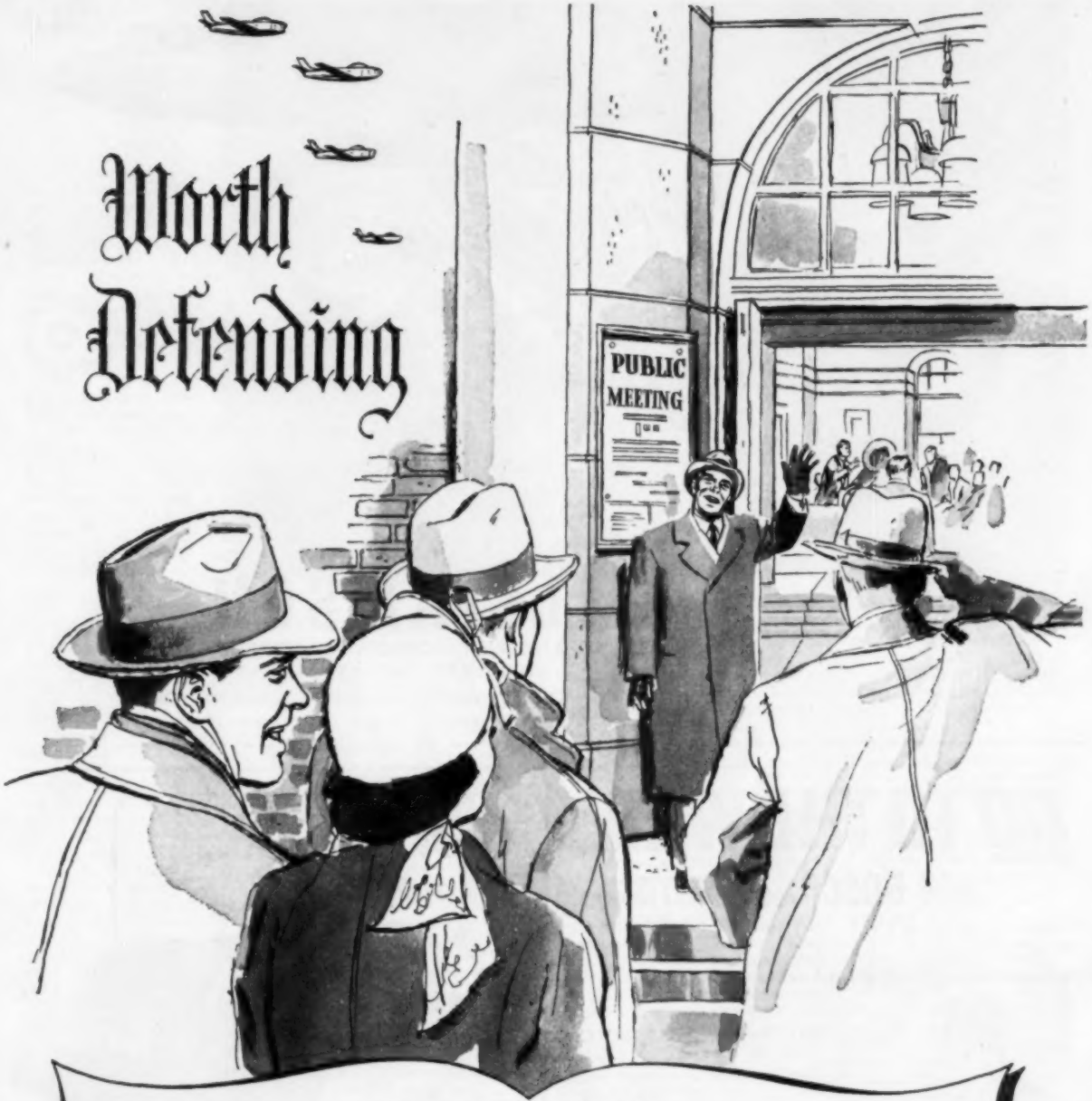
IN the 1953 annual report of Sabena, the Belgian airline, it is stated that expenditure during the year exceeded revenue by 23,600,000 Belgian francs (£168,500). In accordance with its articles of association, the airline has asked the Belgian Government to make good this loss, which represents less than 1.5 per cent of total operating receipts and will be recoverable from future profits.

Though the fact is not reflected in the financial results, Sabena's traffic expanded considerably last year. The number of passengers carried by the company's fleet of 57 aircraft rose by 35 per cent to a total of 375,000 and the number of ton-miles flown increased by 28 per cent.

The increase in traffic is said to have been essentially in tourist-type business, and, say Sabena, the increase has not been commensurate with the decrease in revenue. While the airline was among the promoters of tourist-class fares on the North Atlantic routes, it considers that their extension into the European services and on the African routes was "excessive, or at least premature". Another factor blamed for the deficit is the reduction in airmail rates which was forced upon airlines by the 1952 congress of the Universal Postal Union and introduced the following year.

The report emphasizes that the Belgian airline has no determining voice in the fixing of international fares and, referring to the I.A.T.A. rate-making machinery, states that Sabena "cannot run counter to the wishes of a large majority without risking the creation of an 'open situation' which would quickly degenerate into a ruinous fare-war". Within the Belgian Congo, however, the fares charged by Sabena are not fixed at I.A.T.A. traffic conferences but are established by the Belgian Minister for the Colonies. The Congo rate-structure has been in force since 1945, but Sabena have not been able to obtain authority to increase fares. The Congo services are not profitable, and last year the loss suffered by services was almost precisely equal to the overall deficit. In defence of I.A.T.A., therefore, it might equally be argued that Belgian national policy, rather than the international rate-making system, was responsible for the financial setback which Sabena received last year.

Worth Defending



FREEDOM OF ASSEMBLY

Public assemblies, the sounding boards of what people feel and want, the moulding pots of public opinion and influence are the sworn foes to any form of autocratic government. They are the first to be banned when totalitarianism gains a foothold — and they never return.

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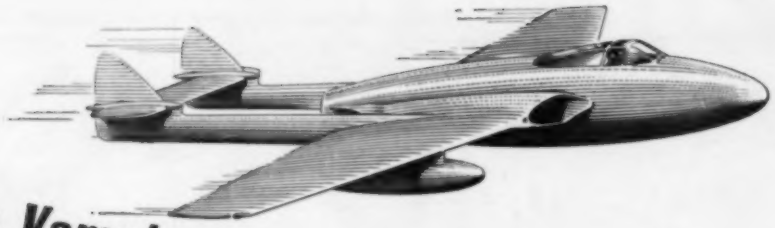

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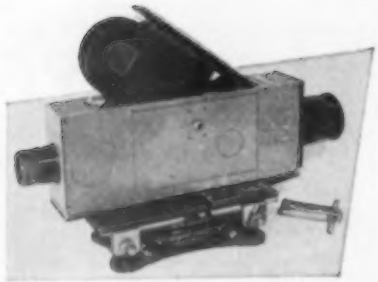

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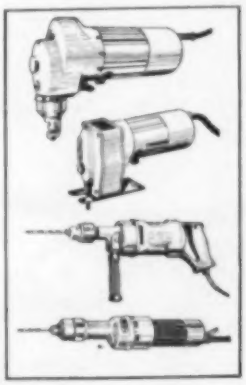

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CIVIL AVIATION . . .

The subject of this exceptionally fine Viscount study is VH-TVA, the flagship of six Series 720s ordered by Trans-Australian Airlines. Commanded by Capt. Frank Fischer, and carrying 22 people including crew, it was due to leave London on Wednesday for Melbourne. The journey was scheduled to take seven days, with stops at Rome, Athens, Beirut, Bahrein, Karachi, Delhi, Calcutta, Bangkok, Singapore, Djakarta, Den Pasar, Darwin and Alice Springs. T.A.A. expect to take delivery of four more Viscounts before Christmas.

CLOUD RADAR FOR UNITED AIRLINES

UP to $4m (£1,400,000) is to be spent by United Air Lines on equipping the majority of their fleet with airborne radar. Experiments with cloud-warning radar have been or are being conducted by a number of airlines, but United are the first to adopt it on a fleet basis.

Their decision follows a four-month period of flight tests with an experimental C-band (5.5 cm) radar developed by the Radio Corporation of America. The equipment was fitted in a DC-3 freighter nicknamed *Sir Echo*, which flew a total of 133 hours in the Denver area. Of 40 flights made by this aircraft, 31 were in actual storm conditions. Aboard the DC-3 was a radar evaluation team who, it is stated, sampled "virtually every type of weather except hurricanes and true nocturnals."

On one occasion the aircraft flew between cells of a violent cloud-burst which flooded railways and ranches, and washed away road bridges. Although 3.10in of rainfall was recorded in 50 min, the radar enabled the DC-3's crew to follow a smooth corridor. United Air Lines say that on no occasion during the trial period did the aircraft encounter heavy turbulence unexpectedly, and that no hailstones of damaging size were met without prior warning from the radar.

The advantages of the C-band radar are summed up by United as follows:—

(1) It is a useful device for safer, smoother navigation of thunderstorm and precipitation areas. It will permit a pilot to avoid moderate and heavier turbulence in these areas, usually by detours of five miles or less from the planned flight path.

(2) It will penetrate 15 miles or more of heavy rain equal to or greater than 60 mm/hr and will not lead a pilot into the hard core of a storm.

(3) It provides a satisfactory warning of hail shafts.

(4) There is considerable indirect evidence that radar will permit the pilot to avoid tornadoes merely by exercising good judgment in detouring sharp-edged echoes and in being suspicious of any fingerlike projection from such echoes.

(5) While the radar is intended primarily for weather mapping, its capabilities for terrain mapping are good.

(6) Radar has little, if any, application in the avoidance of other aircraft.

In a footnote, Mr. E. A. Post, superintendent of navigational aids for United, points out that C-band radar will permit a pilot to detour a storm area after having scanned it from over 75 miles or more away or to choose a corridor of the mildest activity or turbulence if penetration of the storm area is desirable or necessary. He says also that radar will be useful in permitting pilots to scan the areas around an airport before taking-off or landing.

Orders for radar will be placed on completion of evaluation tests with production equipment, and installation is due to begin next spring. Radar will be fitted to 150 of United's fleet of 176 aircraft (Convair 340s, DC-3s, DC-4s, DC-6Bs, DC-7s and Stratocruisers).

The president of United Air Lines, Mr. W. A. Patterson, has said that he regards radar for airline use as "one of the great technological advances of the last ten years." Many pilots in this country and elsewhere will endorse this opinion. The International Federation of Air Line Pilots' Associations, for example, has passed resolutions urging the adoption of airborne radar at its last three annual meetings.

The cost and weight of radar have been the main obstacles to its adoption by the airlines, though the figures published by United suggest that it is now becoming available for a reasonable outlay—bearing in mind the high value and revenue-earning capacity of modern aircraft. A typical airborne radar installation may weigh as much as a passenger and baggage, but this sacrifice of payload may be more than offset by the extra revenue earned by maintaining schedules through bad-weather areas (particularly at night) and also by saving the fuel needed to make visual detours round patches of turbulence.

VISCOUNT "KNOW-HOW" FROM B.E.A.

ASSISTANCE in the introduction of Viscount airliners into service with a number of foreign airlines is being provided by the training branch of British European Airways. As the first operator of regular Viscount scheduled services, B.E.A. have proved well qualified to supply conversion information for both pilots and engineers. The pilot training involves at least 14 weeks' training, including a considerable amount of actual route flying in the first officer's seat of Viscounts operating on continental services. So far, a total of 18 pilots from other airlines have taken advantage of the scheme. The Corporation has been instructing engineers from other airlines in Viscount maintenance procedure since November, 1953, and the intention is that this programme will now be expanded.

B.O.A.C. FLIGHT ADVISORY COMMITTEE

WITH the object of ensuring that operational staff, particularly flight crews, are fully informed of advances in civil aircraft operation, B.O.A.C. have formed a special committee, responsible to the operations director, Sir Victor Tait. Chairman of the new group, known as the Flight Advisory Committee, is the Corporation's operations development director (Mr. A. C. Campbell Orde): among its functions will be the consideration of operational developments, in their specific application to B.O.A.C. activities.

The new committee is composed of the flight superintendent and officer in charge of flying training of each of the aircraft fleets and, in addition, one captain from each fleet will attend the committee meetings. Mr. E. W. Pike (control and navigation superintendent) is secretary. Flying and engineering staff are to be encouraged to suggest improvements in the airline's technical operations; specialists will be co-opted when necessary; and the committee's members will retain contact with appropriate research establishments, manufacturers, training establishments and other operators.

CIVIL AVIATION...

Ten days after delivery on September 7th, the first of Seaboard and Western Airlines' fleet of four Super Constellation freighters, N-6501C "American Air Trader," flew from Hamburg to Idlewild with 27,458 lb. of merchandise —believed to be a record westbound load.

AWARD FOR B.O.A.C. LIVESTOCK PILOTS

THE Industrial Court has awarded additional payment, effective from September 1st, of 7s per flying hour to B.O.A.C. pilots of York freighter aircraft carrying livestock as the main cargo.

The negotiations leading up to the award, which was made at a hearing in London on October 2nd, began in March 1953, when the British Air Line Pilots' Association requested B.O.A.C. to give special consideration to the conditions of service of these pilots. The claim was rejected by the Corporation in May 1953 and in the same month the Association lodged a claim for a special allowance of £1 per flying hour for York pilots engaged in the carriage of livestock. In support of the claim B.A.L.P.A. presented a long list of the unpleasant aspects of the work, including the possibility of illness or injury and the obnoxious atmosphere in animal-carrying aircraft.

B.O.A.C. responded with an offer of 5s per day to compensate the pilots for additional expenditure on clothing and personal hygiene. The Corporation contended that it was not laid down that the duties of a pilot must always be of a pleasant nature: pilots, in common with other employees, it was claimed, must accept the good jobs and the bad jobs that were inherent in the work of the company by which they were employed. The sickness records of pilots engaged on freight operations were no better and no worse than pilots engaged on other types of work. Since the pilots and employers were unable to reach agreement, the matter was referred to the Industrial Court for settlement, with the result reported above.

MANCHESTER'S MILLION

THE millionth post-war passenger passed through Manchester Airport on September 29th. The passenger, Mr. John Holmes, who was boarding a B.E.A. Pionair for the Isle of Man, was greeted by the chairman of Manchester's airport Committee, Councillor L. Biggs, and the deputy airport manager, Mr. K. Thompson, who refunded his fare and presented him with a pigskin wallet to mark the occasion.

NEW AMSTERDAM-SYDNEY SERVICE

A SUPER CONSTELLATION service from Amsterdam to Sydney will be inaugurated by K.L.M. on October 31st. The aircraft, which takes over this weekly service from a Constellation 749, will carry 52 passengers in three different classes of accommodation: 15 in the tourist-class cabin, 30 in the first-class compartment, and seven in the de luxe cabin.

GATWICK-L.A.P. HELICOPTER SERVICE

THE inaugural flight on the extension to B.E.A.'s helicopter service between Gatwick and London Airport was made last Monday, when Redifon, Ltd., shipped 700 lb of Sabre Flight Simulator components from Gatwick. The freight was to be picked up by an R.C.A.F. aircraft and flown straight to Canada. Since the Bristol 171 which operates B.E.A.'s service between London Airport and Eastleigh, Southampton, normally makes a positioning flight between Gatwick and London for each round trip it was decided to open this flight to fare-paying passengers and freight. Now that winter schedules are in force, the complete route is flown only once, instead of twice, daily.

The flight, which is the first British helicopter freight service with British equipment, takes between 15 and 20 minutes, compared with a round 2 hr by road.

Further consignments of Redifon equipment will go to London Airport in future by the same means, until the company's $4,000,000 Canadian contract is completed in the early spring. The pilot on the inaugural flight was 1st Off. J. W. Reid, of B.E.A.'s Helicopter Unit.

THE "B.O.A.C. BUDGET" PLAN

ON November 1st B.O.A.C. will introduce a system of ticket-purchase by deferred payments, to be known as the "B.O.A.C. Budget" plan. This news follows the success of Pan American's "Pay Later" scheme, which was quickly adopted by other leading U.S. airlines. Initially the B.O.A.C. plan applies only to sales originating in the U.S., though it is hoped soon to extend it to Canada and the U.K.; under the plan, passengers can obtain a ticket for 10 per cent of its cost, paying off the balance by instalments over a period of up to 20 months.

AIRWORK TROOPING CONTRACT BEGINS

THE recently announced contract for large-scale trooping awarded to Airwork, Ltd., was inaugurated on Sunday last, when Hermes G-AKFP took off from Blackbushe for Rome at 1030 hr on the first leg of the three-day journey to Singapore. It carried a total of 68 troops and families, who were addressed prior to the flight by Maj.-Gen. A. T. de Rhé-Philipe, C.B., O.B.E., War Office Director of Movements. E.T.A. Singapore was 0835 hr G.M.T. on Wednesday, October 6th.

Normally a flight crew of four, plus two stewardesses, will be carried on the Singapore flights, although on this particular occasion there was a third stewardess. Crews are changed at Nicosia and Bangkok. The inaugural flight was commanded by Capt. D. S. F. Winsland; other crew-members were 1st Off. T. A. Waller, Rad. Off. J. R. Carroll, Eng. Off. L. N. Flower, and Stewardesses Hodgson, Ackland, and Cooke.

The company's Hermes 4As are to be used exclusively on the Blackbushe - Singapore flights, which were intended initially to cover the transport of 7,000 passengers per year for 2½ years. The company now states that additional contracts involving Royal Navy personnel are likely to increase this figure to over 10,000 per year.

Hermes G-AKFP taxies out at Blackbushe to begin the first flight of Airwork's new Far East trooping contract (see news item above). "Flight" photograph

SERVICE AVIATION

Royal Air Force and Fleet Air Arm News

An echelon starboard by the Meteors of No. 611 (West Lancs) Squadron, R.Aux.A.F., over Valetta and the Grand Harbour, Malta, G.C., during the unit's summer training camp this year.

Sir John Boothman Promoted

THE promotion has been announced of Air Marshal Sir John N. Boothman, K.C.B., K.B.E., D.F.C., A.F.C., to the rank of Air Chief Marshal.

Sir John for the past 10 months has been A.O.C-in-C. Coastal Command and was previously Controller of Supplies (Air) at M.O.S. and an additional member of the Air Council. From November 1948 to September 1950 he was A.O.C. A.H.Q. Iraq, going abroad on the completion of his appointment as Assistant C.A.S. (Technical Requirements).

Other appointments include those of commanding the Aeroplane and Armament Experimental Establishment at Boscombe Down and No. 106 Group, a photographic reconnaissance group in Coastal Command.

One of his outstanding feats as a flight lieutenant was the winning for Great Britain of the Schneider Trophy contest in 1931. Flying a Supermarine S.6B seaplane, he averaged 340.1 m.p.h.

Henlow Graduation

AT the graduation parade of No. 2 Entry of Technical Cadets (University) of R.A.F. Technical College, Henlow, on September 24th, Marshal of the Royal Air Force Sir William Dickson was the reviewing officer. No. 2 Entry consisted of 21 cadets who will now pass on to universities to take honours degrees in technical subjects before returning to the Service to take up their duties.

Sir William Dickson reviewed the parade, which was commanded by Tech. Cdt. D. J. Sledge, and presented the Norton sword, for the university cadet achieving the highest all-round standard, to Tech. Cdt. J. J. D. Brown. At a subsequent ceremony in the assembly hall, Sir William Dickson presented the Franks Trophy to Tech. Cdt. D. J. Sledge, the Mathematics Prize to Tech. Cdt. J. L. Seldon, and the Science Prize to Tech. Cdt. J. J. D. Brown.

In a speech after the ceremony, the A.O.C. and Commandant of the College, A. Cdre. C. L. Dann, summarized the cadets' activities and wished them good luck. They were, he said, the pioneers of a scheme for allowing R.A.F. technical Cadets to obtain advanced university education.

The A.O.C-in-C., Technical Training Command, Air Marshal Sir Victor Groom, and the Commandant of the College, were on the saluting base with the reviewing officer.

Queen's Equerry Appointed

THE *London Gazette* of October 1st announced the appointment of F/L. C. C. Blount to be a temporary equerry to the Queen.

For the past two years F/L. Blount has been Regular Adjutant of No. 615 (County of Surrey) Squadron R.Aux.A.F., winners for 1953 of the Esher Trophy. He is the son of the late A.V-M. C. H. B. Blount, who was A.O.C. Air Component of the R.A.F. in France early in the war and was killed in an air accident in 1940.

In the course of his flying career F/L. Blount has—in addition to serving in operational squadrons — completed an instructors' course at C.F.S. and spent a year at Cranwell as a flying instructor.

Northern Norway Survey

EXPECTED to take off from Manby on October 11th, the R.A.F. Flying College's Canberra *Aries IV* is flying to Bodö, Norway, to make survey flights within the Arctic Circle. In support of *Aries* will be a Hastings aircraft carrying ground crews. The detachment will last three days, flights being made from Bodö, Bardufoss and Spitzbergen.

In command will be the A.O.C. and Commandant of the R.A.F. Flying College, A. Cdre. G. A. Walker, who will also fly as second pilot of the Hastings. W/C. M. D. Lyne will captain the Canberra and W/C. A. H. Humphrey the Hastings.

Distinguished Flying Cross

THE *London Gazette* of September 21st announced that the Queen had been graciously pleased to approve the award of the D.F.C. to F/L. H. Watkin-Jones for distinguished service in operations in Kenya. F/L. Watkin-Jones has been serving with No. 1340 Flight since April 1953, flying Harvards against the Mau Mau.

The official citation, in part, reads: "During the last 15 months he has flown 361 operational sorties involving 270 flying hours. He has set a high standard by his exceptional skill and determination in operations, and has inspired his flight and squadron by his enthusiasm and drive. F/L. Watkin-Jones has operated over the most difficult and treacherous terrain by day and night, in all weathers, at high altitudes, in aircraft with only marginal performance.

(Left) Marshal of the R.A.F. Sir William F. Dickson presents the Norton Sword to Tech. Cdt. J. J. D. Brown at Henlow.

(Right) Admiral Sir George Creasy, C-in-C. Portsmouth, takes the salute during a recent visit to Coastal Command H.Q. With him on the dais are Air Chief Marshal Sir John N. Boothman, A.V-M. P. D. Cracroft, Senior Air Staff Officer, and S/L. Merrick.

SERVICE AVIATION . . .

previous Commandants at Henlow, and A.V-M. R. G. Hart, Director-General of Engineering, Air Ministry.

Flying Branch Ground Section

A GROUND section of the General Duties branch of the Royal Air Force is to be introduced which will utilize the flying experience gained by holders of the flying badge to the best advantage in between flying tours and on permanent withdrawal from flying duties.

The ground section will include the following duties: aircraft control, fighter control (including radar supervision), photographic and photographic interpretation, and balloon.

As a result of the formation of the ground section the present Aircraft Control and Fighter Control Branches will cease to exist, as from December 31st, and officers, including those of the W.R.A.F. in these branches, will be transferred to the new section. Suitable annotations, showing their particular function in the ground section, will be prefixed to their names in the Air Force List. There will still remain, however, a requirement for the direct entry from civilian life for these duties.

Introduction of this ground section will give greater opportunities for a number of R.A.F. officers who, normally finishing their flying careers at 43 but with seven years of service remaining before retirement, will now be able to fill ground appointments in posts where their background of flying will be particularly valuable.

R.Aux.A.F. Appointment

THE Air Ministry has announced the appointment of S/L. D. M. Clause, A.F.C., a Regular officer, to command No. 500 (County of Kent) Squadron, R.Aux.A.F., in succession to S/L. Villiers.

S/L. Clause learned to fly in Rhodesia and in 1944 joined No. 143 Squadron for operations. While on an anti-shipping attack his aircraft was shot down, but he landed in Sweden and later returned to Britain.

Since the war he has twice held appointments at both Cranwell College and the Central Flying School. Before taking command of No. 500 Squadron he completed a course at the Day Fighter Leaders' School.

Jubilee Presentation

TO mark the occasion of the twenty-fifth anniversary of his joining No. 600 (City of London) Squadron, R.Aux.A.F., F/L. John Wright, M.B.E., has presented the unit with an engraved ceremonial sword for the use of the Squadron Standard bearer.

F/L. Wright joined No. 600 Squadron on September 23rd, 1929, as an A/C.2 carpenter rigger under training. At the outbreak of war in 1939 he was a metal rigger with the rank of flight sergeant and served with No. 600 until March 1942, when he was discharged from the Auxiliary Air Force on being granted a commission in the V.R. Technical Branch. In this capacity he served with No. 58 O.T.U. and No. 38 and 238 Groups (Airborne Forces).

Immediately the Royal Auxiliary Air Force was re-established he rejoined the squadron as Engineer Officer (Auxiliary). He was awarded the M.B.E. in the Birthday Honours of 1951 and in May of this year was given a second clasp to his Air Efficiency award.

Reunions

A REUNION dinner for the Royal Naval Air Service, Eastern Mediterranean 1914-1918, is to be held on October 23rd. Details from A. G. Furlong, 29 Kenton Park Avenue, Kenton, Middlesex.

A joint reunion of Nos. 50 and 61 Squadrons is to be held on Saturday, November 6th, at the Cock Tavern, Fleet Street, London, E.C.4. Tickets (8s 6d) from Jack Lascelles, 15 Crantock Road, Catford, London, S.E.6.

The ninth all-ranks reunion of No. 85 Squadron will be held in London on Saturday, November 13th. Tickets (15s) and particulars from J. Roberts, 14 Carisbrook Close, Enfield, Middlesex.

TRAINING CARRIER

(Continued from page 541)

Italians had nearly half their heavy ships put out of action.

The carrier operated from 170 miles south of Taranto. In addition to her own aircraft she had embarked six more Swordfish from *Eagle*, making 24 in all. The strike was flown off in two waves, preceded by two aircraft to drop flares. Heavy A.A. fire was experienced over the target but the dive-bombing Fulmars and the torpedo-dropping Swordfish sunk one battleship, severely damaged two more and two heavy cruisers. Two Swordfish were lost.

With the Italian battle fleet more or less immobilized, Admiral Cunningham considered it was safe to run vital convoys through the Mediterranean. By this time, however, the Germans had taken over from their incompetent allies, and on January 10th, 1941, they employed Ju 87 dive bombers in an attack against a convoy for Malta; the attack was concentrated on *Illustrious*. Witnesses said that at times the ship was completely hidden by a forest of bomb splashes. The ship was hit six times and 83 officers and men lost their lives. During the attack the Fulmars landed in Malta, refuelled and were back in time to shoot down a further six Ju 87s.

Although badly hit, *Illustrious* was able to make Malta at 17 kt under her own steam. Here emergency repairs were made under fire. She was dive-bombed every day for 12 days but sustained only one more direct hit before leaving for Alexandria. From Egypt she went to the Norfolk Navy Yard, Virginia, U.S.A., for a refit in which the bow and stern were rebuilt.

By March 1942 the carrier had been repaired and was part of the Eastern Fleet as flagship of Rear-Admiral Boyd, her first captain. Here she formed part of the force which invaded Madagascar to prevent the Japanese using the island as a base. Nine months later she returned to the United Kingdom for repairs and modernization.

"Flight" photograph

Hooked: With undercarriage still clear of the deck an Avenger of No. 815 Squadron picks up an arrester wire on H.M.S. Illustrious.

Having trained and worked up a squadron of Fairey Barracuda torpedo bombers, *Illustrious* returned to the fray in the landings at Salerno, Italy, in the later part of 1943 and from there went on to join the Eastern Fleet once more. Here, working with the American carrier U.S.S. *Saratoga*, she made attacks against Japanese installations at Sabang, Surabaya, Port Blair and Belawan.

Illustrious joined the then newly formed British Pacific Fleet at Sydney in January 1945, but was in dock for a time while repairs were made to the centre propeller, which had been damaged by a near miss. Off Formosa the carrier had a lucky escape from a Japanese suicide aircraft, the wing of which struck the "island"; the aircraft exploded in the sea. As a souvenir, a cylinder block was blown back on to the flight deck. The ship's final operation of the war was the invasion of the island of Okinawa, where she provided air cover for the assault forces.

Two hundred and forty-six officers and men gave their lives while serving in *Illustrious* during the war.

Since the war she has been employed on the Home Station as Trials and Training Carrier, Trial Carrier alone, testing new aircraft, equipment and techniques, and is now Training Carrier. In 1951 she made three trips carrying officers and men of the Third Infantry Division to Cyprus at short notice.

The ship's motto is *Vox Non Incerta* ("No Uncertain Sound") and to this is coupled the three trumpets of the ship's badge with a verse from St. Paul's First Epistle to the Corinthians: "If the trumpet give an uncertain sound, who shall prepare himself to the battle?" J.Y.

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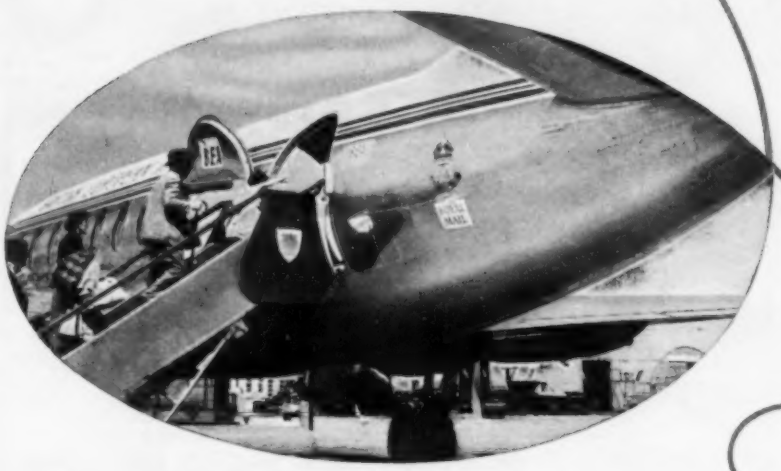

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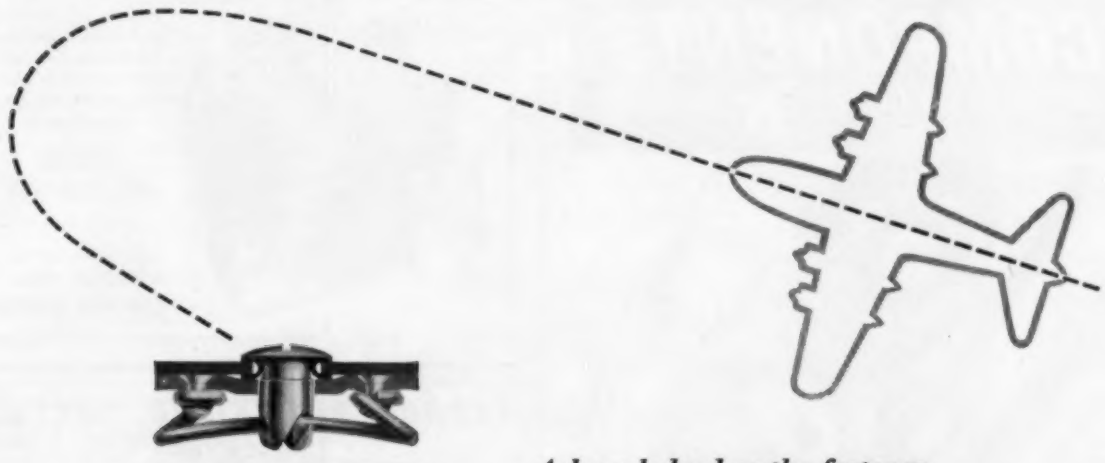

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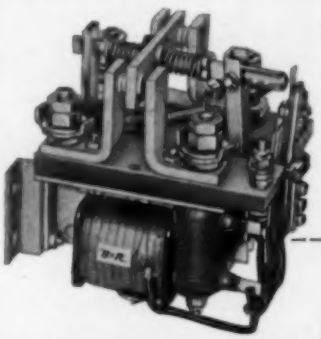

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PUBLIC ANNOUNCEMENTS

AIR TRANSPORT ADVISORY COUNCIL

THE Air Transport Advisory Council give notice that they have received the undermentioned applications to operate scheduled air services:—

APPLICATION No. 9/3. From Don Everall (Aviation) Ltd. of Elmdon Airport, Birmingham, for amendments to the terms of the approval given by the Minister of Transport and Civil Aviation to their internal service Leicester-Birmingham-Guernsey-Jersey for the period up to December 31st, 1959, to permit the Company to operate with D.H.89 aircraft one direct return service each Sunday between Birmingham and Jersey and/or Guernsey in addition to the two direct return services on Saturday already approved, and also to operate by way of a technical stop at Hurn one service daily between Leicester and/or Coventry and Jersey and/or Guernsey with additional services on Friday, Saturday and Sunday in accordance with traffic demand.

APPLICATION No. 371. From Aquila Airways Ltd., of 1 Great Cumberland Place, London W.1, for an all-freight service initially with Solent flying boats and later possibly with a more modern type of aircraft for the carriage of freight between Southampton (Marine) and Perth (Australia) with intermediate traffic stops at Malta, Cyprus or Egypt, Bahrein or Kuwait, Karachi, Ceylon, Singapore and Sourabaya, at a frequency of one service weekly increasing according to traffic demand for a period of 10 years, commencing three months after date of approval.

APPLICATION No. 372. From Transair Ltd., of Croydon Airport, Surrey. For a seasonal inclusive tour service, in conjunction with the Methodist Guild Continental Holidays, with Dakota aircraft for the carriage of passengers and supplementary freight between London (Croydon or Gatwick) and Basle at a frequency of nine return services during the period from June 3rd to September 2nd, 1955, inclusive.

FROM Eagle Aviation Ltd., of 29 Clarges Street, London W.1:—

FOR seasonal normal scheduled services for the carriage of passengers, supplementary freight and mail:—

APPLICATION No. 373: with Dakota aircraft between London (Blackbushe) and Innsbruck (Hotting) with an intermediate traffic stop at Luxembourg at a frequency of up to four services weekly initially, possibly increasing later according to demand during the season from June to October inclusive, and from December 15th to April 30th each year for a period of seven years, commencing June 1st, 1955.

APPLICATION No. 374: with Dakota and Viking aircraft between London (Blackbushe) and Venice (San Nicolo/Treviso) at a frequency of up to four services weekly initially possibly increasing later according to demand during the season from April to October inclusive, each year for a period of seven years, commencing June 1st, 1955, and also from December 1st, 1955, to April 15th, 1956.

APPLICATION No. 375: with Dakota and Viking aircraft between London (Blackbushe) and Pisa (San Giuste) at a frequency of up to four services weekly initially, possibly increasing later according to demand during the season from June to October inclusive each year for a period of seven years, commencing June 1st, 1955.

APPLICATION No. 376: with Dakota and Viking aircraft between London (Blackbushe) and Turin (Casella) at a frequency of up to four services weekly initially, possibly increasing later according to demand during the season from June to October inclusive and from December 15th to May 1st each year for a period of seven years, commencing June 1st, 1955.

FOR seasonal inclusive tour services in conjunction with Sir Henry Lunn Ltd., for the carriage of passengers and supplementary freight:—

APPLICATION No. 377: with Dakota aircraft between London (Blackbushe) and Innsbruck (Hotting) at a frequency of up to four services weekly initially, possibly increasing later according to demand during the season from June to October inclusive, and from December 15th to April 30th each year, for a period of seven years, commencing June 1st, 1955.

APPLICATION No. 378: with Dakota and Viking aircraft between London (Blackbushe) and Venice (San Nicolo/Treviso) at a frequency of up to four services weekly initially, possibly increasing later according to demand during the season from June to October inclusive each year for a period of seven years, commencing June 1st, 1955.

APPLICATION No. 379: with Dakota aircraft between London (Blackbushe) and Rijeka at a frequency of up to four services weekly initially, possibly

(*Continued at top of column* 1, *page* 29)

PUBLIC ANNOUNCEMENTS

(*Continued from column 3, page 28*)

increasing later according to demand during the season May to October inclusive each year for a period of seven years, commencing May 1st, 1955.

APPLICATION No. 380: with Dakota and Viking aircraft between London (Blackbushe) and Pisa (San Guiste) at a frequency of up to four services weekly initially, possibly increasing later according to demand during the season June to October inclusive each year for a period of seven years, commencing June 1st, 1955.

APPLICATION No. 381: with Dakota and Viking aircraft between London (Blackbushe) and Turin (Caselle) at a frequency of up to four services weekly initially, possibly increasing later according to demand during the season June to October inclusive and from December 15th to May 1st each year for a period of seven years, commencing June 1st, 1955.

APPLICATION No. 382. From Yeadon Aviation Ltd., of Yeadon Airfield, nr. Leeds. For a seasonal U.K. internal service initially with D.H.89A aircraft for the carriage of passengers, supplementary freight and mail between Leeds (Yeadon) and Isle of Man (Ronaldsway) at a frequency of one to 14 services weekly during the season from April to September inclusive for a period of seven years, commencing April 1st, 1955.

APPLICATION No. 383. From Eagle Aviation Ltd., of 29 Clarges Street, London, W.1. For a seasonal inclusive tour service, in conjunction with Whitehall Travel Ltd., with Viking aircraft for the carriage of passengers and supplementary freight between London (Blackbushe) and Valencia (Manises) at a frequency of one service fortnightly during the season from May to October inclusive for a period of seven years, commencing May 1st, 1955.

APPLICATION No. 384. From B.K.S. Air Transport Ltd., of 13a Old Burlington Street, London W.1. For a U.K. internal service with Dakota aircraft for the carriage of passengers, supplementary freight and mail between Southend and Isle of Wight (Bembridge) with an intermediate traffic stop at Shoreham at a frequency of from one to 14 services weekly initially, during the season from April to October inclusive for a period of seven years, commencing May 1st, 1955.

FROM Air Kruise (Kent) Ltd., of Lympne Airport, Kent:—

APPLICATION No. 385. For a seasonal inclusive tour service in conjunction with Sheffield United Tours, with Dakota aircraft for the carriage of passengers between Manchester and Geneva at a frequency of from one to two services weekly during the season from April to October inclusive for a period of seven years, commencing April 1st, 1955.

APPLICATION No. 386. For a seasonal inclusive tour service in conjunction with Blue Cars Continental Coach-Cruises Ltd., with Dakota aircraft for the carriage of passengers between Lympne and/or Perryfield and Geneva at a frequency of from one to two services weekly during the season from April to October inclusive for a period of seven years, commencing April 1st, 1955.

THESE applications will be considered by the Council under the Terms of Reference issued to them by the Minister of Civil Aviation on July 30th, 1952. Any representations or objections with regard to these applications must be made in writing stating the reasons, and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 3 Dean's Yard, Westminster, London S.W.1, from whom further details of the applications may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, should reach them within the period allowed for the making of representations or objections. [2693

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The engagement of persons answering these advertisements must be made through the local office of the Ministry of Labour and National Service, etc., if the applicant is a man aged 18-64 or a woman aged 18-59 inclusive, unless he or she or the employer is excepted from the provisions of The Notification of Vacancies Order 1952.

AIRCRAFT draughtsmen and stressmen required.—Apply, stating age, experience and salary required, to Aviation and Engineering Projects Ltd., Alexandra Road, Hounslow. HOUnslow 9621. [2685

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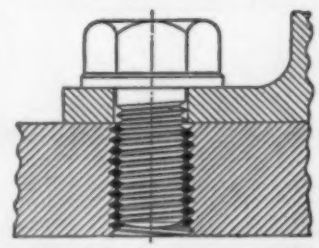

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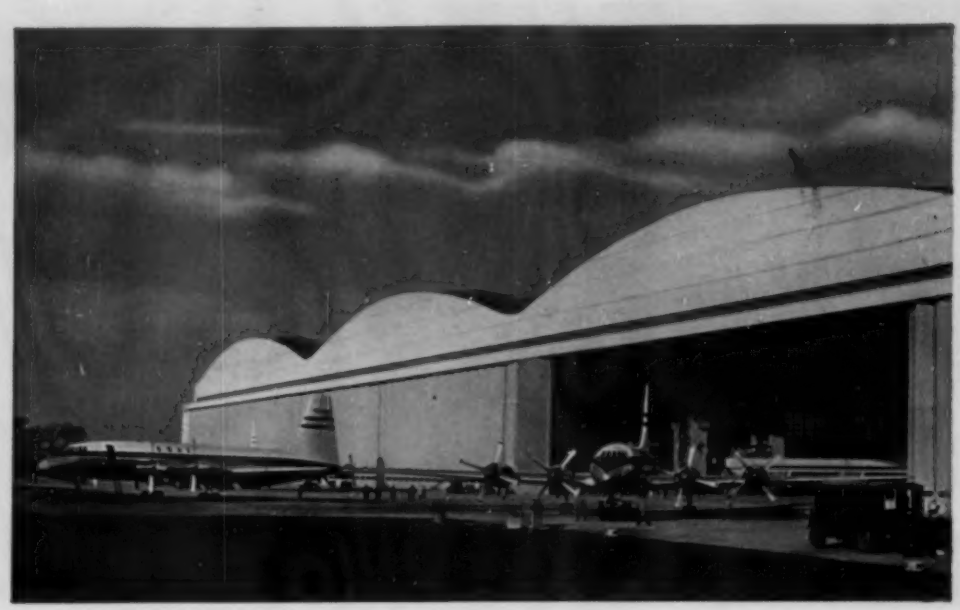

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